The *"Silent Scream"* of *"Pathetic Seeds"*[1]

Exploring a Feminist Ethics of Care as a means to Broaden the Scope of Current GM Crop Risk Assessment Practices in South Africa

By

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ABSTRACT

The risk assessment of genetically modified (GM) crops is assumed to be a benign regulatory tool, due to its perceived objectivity and freedom from the morals and values that pervade society. Yet, against the backdrop of growing environmental pressures, social tensions and political instability, problems that cannot be accommodated in the current regulatory framework in South Africa are consistently emerging. This calls for a reformation of regulatory procedures to account for problems neglected by the current science-based risk approach to the assessment of GM crops. To achieve this, the research methodologies adopt a feminist- pragmatist approach that allows for the use of mixed methods and emphasises reflexivity to allow new perspectives to appear. The research aims to (1) study current risk assessment procedures for GM crops and their historical evolution; (2) address concerns that have arisen from this approach; and (3) investigate the suitability of a Feminist Ethics of Care as an alternative lens through which to view the assessment of GM crops in South Africa. Using themes derived from feminist literature such as **relationships**, **particularity** and **context**, **power** and **vulnerability**, **narrative** and **voice**, **emotions** and new conceptualisations of the **public/private** dichotomy, new 'ways of seeing' risk emerge and illuminate salient issues that are so often neglected by the current science-based risk approach. An articulation of this alternative is explored in order to provide critical and practical policy recommendations. The thesis concludes by expressing the limitations of a Feminist Ethics of Care in the context of South Africa and reveals how a post-development paradigm may help to formulate a more appropriate framework for GM crop assessment.

[1] The inspiration for this title was taken from two of the interviews conducted for this research.

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List of Abbreviations

ACB	African Centre for Biodiversity
ACRE	Advisory Committee on the Release to the Environment (UK)
CBP	Cartagena Protocol on Biosafety
DAFF	Department of Agriculture Forest and Fisheries (South Africa)
DEFRA	Department of Environment, Food and Rural Affairs (EU)
DETR	Department of Environment, Transport and Regions (UK)
DFID	Department for International Development (UK)
DIRNAT	Norwegian Directorate for Nature Management (Norway)
DST	Department of Science and Technology (South Africa)
DTI	Department of Trade and Industry (South Africa)
EC	Executive Council
EU	European Union
FAO	Food and Agriculture Organisation of the UN
FDA	Food and Drug Administration (USA)
GDP	Gross Domestic Product
GM	Genetically Modified/Genetic Modification
GMO	Genetically Modified Organism
GRAS	Generally Recognised as Safe
HYV	High Yielding Variety
IPR	Intellectual Property Rights
LMO	Living Modified Organisms
NGO	Non-Governmental Organisation
NDP	National Development Plan (South Africa)
NGP	National Growth Plan (South Africa)
NP	National Party (South Africa)
PLAS	Proactive Land Acquisition Strategy (South Africa)
PRSP	Poverty Reduction Strategy Paper
PFOA	Problem Formulation and Options Assessment
PSE	Principle of Substantial Equivalence
RA	Risk Assessment
RIKILT	National Institute for Quality Control of Agricultural Products (Netherlands)
SAGENE	South African Committee for Genetic Experimentation (South Africa)
SIDA	Swedish International Development Cooperation Agency (Sweden)
SPRU	Science and Policy Research Unit (UK)
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
WTO	World Trade Organisation

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CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Genetic modification (GM) is a phrase that can induce shudders in some and provoke excitement and imagination in others. In agriculture, certain scientists hold the perception that the process of genetic modification is a mere extension of older, more traditional techniques of selective breeding (FAO 1991, Suslow, Thomas and Bradford 2002, Yashon and Cummings 2012), while other perspectives assert that it represents an immoral interference with nature (Beekman and Brom 2007, Devos *et al* 2008, Shiva 1993). These polarising perspectives have infiltrated both academic spaces and public discourse, which makes policy conclusions difficult. Often, concerns that are raised, both in academic spheres and in the public realm, pertain not to scientifically measurable observations but to personal, subjective and emotional instincts or feelings that are rarely taken seriously in policy and government discourse. Risk governance of GM crops and GM food products is currently subject to intense scientific and public controversy. Scientists and representatives of the biotechnology industry have dominated formal spaces in which issues concerning safety and regulation are deliberated. "The public is suspicious with regard to the motives of scientists, companies, and political institutions involved. The dilemmas posed are nested, embracing value questions, scientific uncertainty, and contextual issues" (Myhr and Traavik 2003, p. 227).

The historical trajectory of GM crops in South Africa has been turbulent to say the least and their future is set to be no less so. The task of deconstructing and understanding the nuances and complexities present in the debate on genetically modified organisms (GMOs) is intricate, convoluted and inconclusive. There are many stakeholders involved at various different levels and in varying capacities, which problematizes the assessment of a technology with such a multifaceted nature. Already, there exists ample research on whether or not GM crops pose harm to human health (Meyerson and Reaser 2002, Dona and Arvanitoyannis 2009, De Marchi and Ravetz 1999), or to the environment (Wolfenbarger and Phifer 2002, Conner, Glare and Nap 2003, Tiedje *et al* 1989), and since the Cartagena Protocol on Biosafety[1], research into the socio-economic effects of planting

[1] The Cartagena Protocol on Biosafety was ratified by South Africa in 2003. It is an international agreement that aims to ensure the safe handling, transport and use of living modified organisms (LMOs) resulting from modern biotechnology that may have adverse effects on biological diversity and human health (CBD 2000).

GM crops has grown. Yet, current risk assessment approaches have not eased the turbulent nature of the GM crop landscape and in many regards, have intensified concerns. In light of this, alternative approaches to assessment are emerging. Preston and Wickson (2016) have began to theoretically apply a feminist ethics of care approach to GM crop assessment and Wickson *et al* (2017) state that even with the growing demand to "incorporate social, economic and ethical considerations into biotechnology governance, there is currently little guidance available for understanding what this means or how it should be done".

The task of this research is therefore not to contribute yet more literature to the perceived risks and benefits of planting GM crops, but to critically investigate current risk assessment procedures and the concerns that have risen from this approach. A further task of this research is to evaluate the suitability of a Feminist Ethics of Care approach in addressing the concerns that are raised. This is accompanied by the intention to broaden the scope of assessment, to illuminate salient issues that are so often neglected by the current science-based risk approach, through the articulation of policy recommendations.

1.2 OVERVIEW

In 2016, the 21st year of commercialization of GM crops, 185.1 million hectares of GM crops were planted by 18 million farmers in 26 countries (ISAA 2017). For the past five years, developing countries have planted more GM crops than industrial countries. In 2016, 19 developing countries planted 54% (99.6 million hectares) of the global biotech hectares, while seven industrial countries took the 46% (85.5 million hectares) share (ISAA 2017). South Africa is currently the leading producer of GM crops in Africa and is the 9th largest producer of GM crops globally, planting 2.3 million hectares in 2016. The country has cultivated, imported and exported GMOs since 1998 and an estimated 86% of the maize produced is genetically modified, over 90% of soy and 100% of cotton (AfricaBio 2013).

In South Africa, no consensus exists over the success or failure of GM agriculture and the regulatory regime through which it has evolved has been critical to both its perceived commercial success and subsequent setbacks (Carroll 2016). South Africa is the only country in the world whose staple food – white maize - is genetically modified. This leaves the food security of those who are the primary consumers of white maize, vulnerable to volatile markets and corporate control. The unequal power

relations implicit in this relationship between farmer, seed and corporation, make it necessary to interrogate the regulatory procedures that assess (or do not assess) such risky relations.

Risk assessment has been able to dominate regulatory procedures due to its perceived objectivity and thus its essences of fairness. However, this research will show how, in reality, particular values are taken seriously and acknowledged, whilst others are not. By understanding how science, throughout history, has come to represent the epitome of truth in contemporary society, under the guise of neutrality, the way in which risk assessment has benefited from these same assumptions can be acknowledged. Moreover, through feminist inquiry, which seeks to question these assumptions, the way in which risk assessment actually allows certain ideals to persist over others can be illuminated. Ethical issues have been judged and said to lie outside of the regulatory capacity, as a matter to be considered separately (DETR 1998). Yet, as Carr and Levidow (2000, p. 29) suggest, "all environmental controversies at root involve disputes about fundamental ethical principles" and therefore must be built into risk appraisal. This study aims to explore how an emphasis on central themes of importance - emerging from a feminist ethics of care such as relationality, context and particularity, power and vulnerability, emotion and narrative can begin to account for and acknowledge significant issues that are habitually ignored by the dominant and largely consequentialist risk assessment framework.

1.3 RATIONALE

South Africa's agricultural sector is dualistic and imbalanced, with a concentrated agricultural production structure. Land dispossession[2], forced removals[3] and the Bantustan policy[4] meant that by 1994, agriculture in South Africa was sharply divided. This divide has resulted in the separation between technologically advanced and capital-intensive forms of large-scale agriculture in former white areas, on 85% of South Africa's agricultural land (DAFF 2014, p. 6) and marginalised, small-scale subsistence farming, carried out by an estimated two million small-scale farming households,

[2] Legal instruments through legislation, resolutions, proclamations and ordinances played a key role in legitimizing systematic land dispossession and segregating South Africa. The Khoi, San and black Africans under the colonial system were dislodged from the land (SAHO 2013).
[3] Forced removals refer to the moving of people from their homes against their will. South Africa has experienced a long history of forcible removal of people as the result of racist legislation (SAHO 2016)
[4] The Bantustans or homelands, established by the Apartheid Government, were areas to which the majority of the black population was moved to prevent them from living in the urban areas of South Africa (SAHO 2011)

concentrated in the former homelands. In 2007, the top 0.6% of farms (237 units) accounted for 33% of total agricultural income (Leibenberg 2010, p. 28). It is against this backdrop, characterized by segregation and inequity that the risk assessment of GM crops operates. This approach to GM crop assessment has been designed to align with the highly productive industrialised agricultural sector, which functions very differently, particularly on socio-economic terms, to the small-scale farming sector. Therefore, investigating the appropriateness of an approach like risk assessment in the context of this dualism is necessary. Further, to explore an alternative assessment approach for GM crops, that considers particular aspects, like socio-economic, political and cultural in more depth may help contribute to the formulation of a more appropriate assessment framework.

1.4 RESEARCH OBJECTIVES

The overall aim of the research is to explore a feminist ethics of care approach as an alternative paradigm with which to assess GM crops in South Africa. In order to achieve this more general aim, three more, specific objectives were constructed,

1) To study and describe the current risk assessment procedure in South Africa and its historical evolution.

2) To explore the concerns that have arisen from this approach.

3) To investigate the suitability of a feminist ethics of care approach to provide an alternative paradigm with which to assess GM crops in the context of South Africa

4) To provide policy recommendations using the research results.

1.5 ORANISATION OF THESIS

The thesis is organized in the following way. The literature review in chapter two gives a summary of genetic modification in agriculture and the controversies that have arisen from it. Following that, an overview of biotechnology governance in a global context will be given, before turning to the regulatory framework of GM crops in South Africa. Further to this, the literature review examines the philosophy of science-based risk assessment, which is imperative for understanding its historical evolution. This is followed by looking at some of the problems that have arisen from this approach. Then, the study gives an overview of a feminist ethics of care as a response to dominant moral theory followed by feminist perspectives on science as a critique of normative theories of science.

Chapter three gives detail on the methodologies that were employed in order to achieve the research aims and objectives. A critique of positivism as a research paradigm in scientific research is explored, followed by an explanation of how feminist pragmatism was decided as the best approach to achieve the research aims. Following that, the positionality of the researcher is explored and sheds light on how positionality affected the research process. Subsequently, an overview of the methods provides a summary of the participants, the interview methods and techniques that were employed and how the data analysis took place, which is then followed by acknowledging the limitations of the chosen methodologies.

Informed by the literature review, chapter four exhibits the findings of the research that were uncovered through the application of the methodologies. Using themes from a feminist ethics of care, and contrasting them with themes from the philosophy of science-based risk assessment, interviews are analysed and the findings are presented. Chapter five moves on to study how appropriate a feminist ethics of care approach might be in the context of GM crops in South Africa. The chapter brings to light themes and reflections that developed from the interviews that were not acknowledged by a feminist ethic of care framework and as a result, proposes a post-development paradigm as a more suitable approach. Chapter six provides the conclusion that ties up the research and provides some policy recommendations, in order to achieve the fourth research objective.

CHAPTER TWO

2.0 LITERATURE REVIEW

The following section seeks to present and critically analyse the relevant literature to provide a backdrop against which the research project took place. It begins by describing the process of genetic modification and how it has developed from more traditional forms of plant breeding, before situating the South African regulatory procedures for GM crops within a global context. This is followed by a deeper look into the philosophical roots of science-based risk assessment and problems associated with this approach. Finally, this section provides an introduction to a feminist ethics of care, including feminist critiques of normative philosophical theories of science.

2.1 THE GOVERNANCE OF BIOTECHNOLOGY

Genetic Modification; A Controversial Technology?

The assessment of the safety and risks of GM crops must be considered in the context of the evolution of crop plants that started thousands of years ago when plants were first domesticated. Throughout history, farmers have selected desirable genetic traits in crops and as a result, have generated plants for more efficient agricultural purposes. These desirable traits have included "crop varieties with shorter growing seasons, increased resistance to disease and pests, larger seeds and fruits, nutritional content, shelf life, and better adaptation to diverse ecological conditions under which crops were grown" (Schlegel 2007, p. 423). This type of biological selection is an example of selective cross breeding, in which new varieties are developed by selecting plants with desirable qualities or, by combining traits from two closely related plants (Schlegel 2007). Such processes have resulted in the development of 'hybrid seeds'[5], discovered in the late 19th century, and over time have resulted in a broad spectrum of varieties for food, feed and fibre production (Wieczorek 2012, p. 9). In the 1940s, it was discovered that genetic mutations occur faster under the process of mutagenesis; this resulted in the use of radiation to alter the base pairs of DNA (which code for the plant's biochemical

[5] Seeds produced by cross-pollinated plants.

instructions for development) (Boyle 2011). The use of ionising radiation, such as X-rays, gamma rays, neutrons and chemical mutagens for inducing variation, is now well established. This process has been used to improve major crops such as wheat, rice, barley, cotton, peanuts and beans (Ahloowalia and Maluszynski 2001). Despite the dynamic nature of plants genomes, few safety concerns have arisen from this type of plant breeding (Jansen van Rijssen *et al* 2015). Towards the end of the 20th century, biotechnology developed in such a way where scientists could take one or more specific genes from virtually any organism, including viruses, bacteria, plants or animals and introduce those genes into the genome of another organism (Wieczorek 2012).

Some observers assumed that GM technology would simply revive the halted Green Revolution[6] of the 1960s and 1970s, in spite of the striking institutional and geopolitical differences that would make the new 'Gene Revolution' a very different creature from its predecessor (Parayil 2003). In an ever-globalising era, characterised by the further entrenchment of capitalism and inequality, an era where the earth and the majority of its inhabitants are increasingly neglected in favour of corporate interest, the GM crop debate occupies an intersectional space at which these various narratives converge. It is at this intersection where convoluting and conflicting narratives collide and where the practice of biotechnology initiates both praise and criticism. Many proponents of the technology state that biotechnological development is vital for human survival in the face of a Malthusian crisis, suggesting that the genetic modification of food crops to increase yield is one way to avoid such catastrophe (e.g. Harvey and Parker 2008, Surman 2008). It is also said to afford scientists greater control during the process of modification (Gepts 2002) allowing for the development of pest resistance, herbicide tolerance and the precise adaptation of crops to withstand diverse ecological conditions (Cassman 1999, Varshney *et al* 2011). In older breeding methods, thousands of genes are being rearranged, whereas genetic modification involves the specific handling of single genes. Molinar (2012) likens the process to using 'chemical scissors'. Other potential benefits such as the reduced environmental impact from pesticides (USDA 2000) and increased yield (Gianessi and Carpenter 1999) have also been cited.

[6] Refers to a set of research and development technology transfer initiatives that aimed to increase agricultural production, particularly in the developing world, primarily through the uptake of new high yielding varieties (HYVs) of seeds and chemicals, paired with a controlled water-supply and new methods of mechanized cultivation (Farmer 1986).

In spite of these potentials, the development and use of GM crops have aroused significant opposition with many critics claiming that the merits of these developments have been exaggerated and the vigorous adoption of the technology has come at a great cost to both society and the environment (Altieri 2001, Friends of the Earth 2008). There are concerns related to potential health and environmental risks, including risk of invasiveness (Pimentel *et al* 2000), direct non-target effects on beneficial and native organisms (Stotzky 2000), indirect effects (Stotzky 2000) and variability and unexpected results (Levin 1989). Further, political-economic questions have been raised pertaining to the ethics of patenting life forms. Vandana Shiva refers to this as the 'privatisation of knowledge' (Shiva 1993), a process that commodifies life itself, breaking socio-ecological relationships between farmers and their seeds and forging new, more volatile and unequal relationships between farmers and agribusiness. While proponents of GM crops, including industry, postulate that it is necessary to let go of sentimental attachment to traditional farmers saving seeds, and transition to high-tech agriculture (which includes GMOs) to improve yields in the face of world hunger and continued population growth.

It is amidst this confusion and polarisation that a risk assessment approach aims to objectively assess the dangers associated with releasing a GMO into the environment. However, Bizzarri (2012) expresses how more effort has gone in to imagining all the possible benefits of genetic modification, rather than evaluating the possible dangers, thus concluding that a risk assessment approach is inadequate. This perspective is shared by other observers (Carr and Levidow 2000, Groves 2009, Stirling 1998, 2010) who claim that a risk assessment framework is incompetent due to the intractability of the issues mentioned above.

By looking at the controversies that have emerged from within the debate on GM crops, the negotiations that must occur between government, industry, farmers and the environment become more complex. It is amidst this complexity that governance structures must operate in a fair and just manner. Studying the way in which biotechnology regulations came about in South Africa begins to illuminate their partial and inequitable origins.

The establishment of SAGENE (South African Committee for Genetic Experimentation) by the apartheid government in 1979 marked the beginning of the institutionalisation of biotechnology regulation in South Africa (SAGENE 1994). It comprised a group of South African scientists and had the intention of leading the drive for biotechnology uptake in the country. Prince and Black (2010) note that the conceptual framework that informs the GMO Act (1997) and subsequent draft of Biosafety Policy (2003) were informed by SAGENE. Mayet (2007) observes that it was with their advice that in 1989, the first open field trials were permitted. Then, in 1994, SAGENE was given legal power to advise government on any legislation or controls relating to GMOs and served as the key advisory body to government until 1999, when the GMO Act was fully adopted (Prince and Black 2010). Mayet (2007, p. 10) notes that 178 permits for open field trials were granted during the interim period (1989 – 1999), in which no government legislation existed. Through the GMO Act, the Executive Council (EC)[7] replaced SAGENE as the institutional authority for GMO decisions. This led to the reconstitution of SAGENE as an Advisory Committee (AC) and a sub-committee to provide expert advice on GM crops releases to the EC[8] (Thomson 2014, Lobbywatch 2011).

Thomson (2014) cites the activities of AfricaBio, established in 1999, as another important factor that contributed to the early uptake of biotechnology in South Africa. As noted in their briefings, AfricaBio represents an *"independent, non-profit biotechnology stakeholders' association for the safe, ethical and responsible research, development and application of biotechnology and its products"* (AfricaBio 2017). In addition to SAGENE and AfricaBio, Thompson (2014, p. 69) cites the presence of many highly sophisticated commercial farmers and the large size of their farms as another reason why GM technology took off so fervently in South Africa[9]. As a result of these factors, in the 15 years from 2000 to 2015, nearly 20 million accumulated hectares of GM maize were grown in South Africa, yielding well over 50 million tonnes of grain, making South Africa the ninth largest adopter of GM technology in the world, with more than 70 per cent of the maize crop totalling some 1.8 million hectares planted (ABI 2016).

[7] The Executive Council is the ultimate decision-making body which approves or rejects GMO applications

[8] The GMO Act, 1997 [2006] Section 13, requires that any members who face a conflict of interest should recuse themselves. Yet several former SAGENE members, whose research is linked with the biotechnology industry continued to advise the government after the adoption of the GMO Act (Prince and Black 2010).

[9] Helliker (2013) and Kheswa (2015) note that the reason that South African farms are so large is due to apartheid legislation which favoured white commercial farms/farming to the neglect of small-holder farming which is associated with the black South African population.

The Genetically Modified Organisms Act of 1997, as amended by Act 23 of 2006, is the principle instrument for regulating GMOs in South Africa. It recognises the potential risks associated with releasing GMOs into the environment, in addition to the risks to human and animal health. However, Prince and Black (2010) state that the recognition of biosafety as a holistic approach to assessment and regulation of genetic modification, based on the Precautionary Principle (PP) is absent in South Africa. They go on to mention that GMOs were introduced into the country in a context where no regulatory framework, biosafety policies or laws were in place.

Table 1. The GMO Act 1997 [2006]

THE GENETICALLY MODIFIED ORGANISMS ACT Promulgated in 1997, Implemented in 1999	○ Ensure activities relating to GMOs are carried out responsibly ○ Includes guidelines for import, export, production, use, release & distribution ○ Aims to limit adverse impact on environment, human/animal health ○ Covers the management of waste ○ Requires measures to evaluate & reduce potential risks ○ Provides the criteria for risk assessment

The Executive Council (EC) is appointed by the DAFF (Department of Agriculture, Forests and Fisheries) Minister and is the ultimate decision-making body, which approves or rejects GMO applications. It comprises representatives from Department of Agriculture, Forests and Fisheries, Department of Environment Affairs, Department of Science and Technology, Department of Health, Department of Trade and Industry, Department of Labour, Department of Water Affairs and Forestry, Department of Arts and Culture and the Chair of the Advisory Committee (AC). Their tasks include: collating recommendation reports from the AC, processing and responding to comments from the public and reviewing responses from the AC to any comment of a scientific nature. With the amendment of the GMO Act in 2006, the EC is also responsible for considering the need for a GMO impact assessment on the environment or requiring a socio-economic impact report if they deem it necessary. The EC is also empowered to appoint any person knowledgeable in the field of science to provide advice. They are also permitted to engage with interest groups and applicants at their request. Decision-making by the EC is on the basis of consensus by all members (Mayet 2007, Prince and Black 2010, DAFF 2013).

The Advisory Committee (AC) consists of ten members appointed by the DAFF Minister. Members are appointed on the basis of their scientific expertise in various fields, some of which have included agricultural biotechnology, bacteriology, entomology, toxicology, molecular biology, plant

physiology and virology (amongst others). The amendment of the GMO Act in 2006 created the possibility for additional capacity to address biosafety. A social scientist has never served on the AC, in spite of South Africa's adherence to the Cartagena Protocol in 2003[10]. The AC serves as the national advisory body on all issues relating to GMOs and provides primary scientific safety assessment of applications (DAFF 2013).

The office of the **Registrar** is also appointed by the DAFF Minister and is tasked with the daily administration of issues relating to GMOs. They issue permits on instruction from the EC, are obliged to keep a register of all facilities used for contained use, all trial release sites and the names and addresses of all people involved in GMO activities. The Registrar can also arrange for inspectors to conduct non-routine investigations (Prince and Black 2010, DAFF 2013).

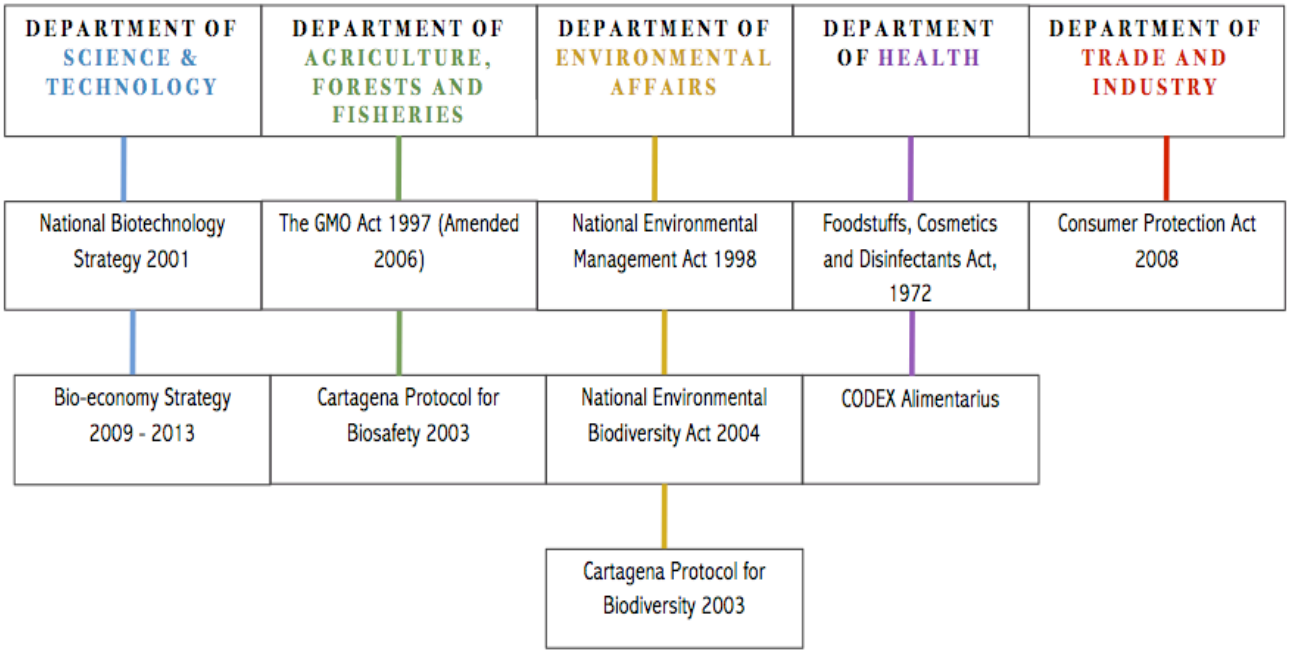


Figure 1. South African Regulatory Framework for GMOs

Permit applications made to the EC must include a scientifically based **Risk Assessment**. This may include a summary of field trials undertaken, pollen spread, seed dispersal, vegetative spread of the GMO), foreign genes and gene products, resistance, human and animal health, pathogenic and ecological impacts (CPB 2000, p. xi). If the risk assessment identifies a risk, **Risk Management** procedures may be developed to minimize or mitigate the risks that have been found. Proof of public

[10] The Cartagena Protocol on Biosafety gives signatories the option to consider the socio-economic impacts of GMOs.

notice[11] is widely regarded as part of risk management (Prince and Black 2010, DAFF 2007). It is then for the AC to examine the risk assessment[12] and make recommendations to the EC. Together with public input, the EC will subsequently make a decision on whether to approve or deny the application. The socio-economic impact assessments are not mandatory and are only included if the Executive Council requests them. Mayet (2007, p. 21) suggests that although a scientifically–based risk assessment is a requirement for decision-making, the GMO Act amendments have been unsuccessful in providing clear details on the processes and mechanisms for the risk assessment[13]. The point of departure for the risk assessment is that if the GMO under consideration can be demonstrated to be substantially equivalent in chemical terms - to its non-GM counterpart, it will not require an independent safety assessment (Prince and Black 2010).

In 2003, South Africa ratified the **Cartagena Protocol on Biosafety (CPB)** to the **Convention on Biological Diversity (CBD)**, an international, legally binding framework of rules that apply to the trans boundary movement, transit and handling of 'living modified organisms' (LMOs)[14] that may impact negatively on the conservation and use of biological diversity and human health (Article 4, CBD 2000). The CPB also allows for signatories to assess the socio-economic impacts of releasing GMOs into the environment, yet these considerations are not mandatory. The GMO Act, as amended in 2006, includes the requirements of the CPB, which describes the requirements for the protection of human health and the environment against possible risk from GMOs. A precautionary approach in the consideration of risks is a central tenet of the CPB, which recommends that signatories integrate its principles into legislation and adhere to the requirements for environmental safety and human health. However, risk/benefit analysis, or scale of risk in applying the precautionary principle (PP), is not addressed in the GMO Act, although it does give room to cite positive or negative socio-economic impacts (Jansen van Rijssen *et al* 2015). In this context of risk assessment and the regulatory decisions that authorities are faced with when dealing with genetic modification of crops,

[11] For general release or commodity clearance applications, the public must be informed through notices placed in three newspapers with a national circulation, whilst field trials must be notified in two newspapers circulated in the immediate release area and one newspaper with national circulation. The public may submit comments to the Office of the Registrar within 30 days from the date on which the public notice was published (Jaftha 2012)

[12] The risk assessment studies are carried out by the applicant/developer and the supporting documentation is often self-funded. The data is often also collected elsewhere in the world (predominantly from the EU/US)

[13] In 2010, Regulation 4 of the GMO Act was amended to make reference to risk assessment methods.

[14] The CBD (2000) defines 'LMO' as "any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology". In everyday usage, LMOs are usually considered to be the same as GMOs (Genetically Modified Organisms), but definitions and interpretations of the term GMO vary widely (CPB 2012).

an understanding of the **Precautionary Principle (PP)** is important. An overview of the PP and its on-going debates on interpretation and implementation will now follow.

The Precautionary Principle

The **Precautionary Principle (PP)** emerged in European environmental policies in the late 1970s and has become increasingly integral to international decision-making and national legislation on issues relating to the environment (Freestone and Hey 1996). It is a risk management strategy that seeks to cope with possible risk to the public and/or environment in the absence of scientific certainty (UNESCO 2005). "Precaution' is generally recognised not as a hypothesis, theory or methodological rule – but as a normative principle for making practical decisions under conditions of scientific uncertainty" (Jansen van Rijssen *et al* 2015, p. 2). It will be noted here that some observers (Levidow *et al* 2005, Jansen van Rijssen *et al* 2015, Myhr and Traavik 2002) cite a difference between a **precautionary approach** and the **precautionary principle.** In the context of GM crops and the CPB, a precautionary approach is recognised as a regulatory philosophy or guiding principle that may be used by regulators to take preventative measures in situations considered as a "threat of significant reduction or loss of biological diversity" (UNEP/CBD 2011, p. 2). Recuerda (2008) concludes that the PP has the connotation of legal language and the interpretation that is used by the EU, whereas the US interprets precaution as an approach – not legally binding.

In the context of GM crops, the lack of independent data and often-insufficient safety information calls for application of the PP in the decision-making process. Stirling and Mayer (2000) assert that a precautionary approach recognises the complications in risk assessment by according a "greater benefit of the doubt" (Stirling and Mayer 2000, p. 300) both to the environment and to public health than to actions that could threaten the state of these factors. Yet, Jansen van Rijssen *et al* (2015) state that in the context of GM crops, ratifying the CPB does not demand that all GM crop applications must undergo extensive safety assessments in order to comply with the precautionary approach as outlined in the CPB - nor does it imply that GMOs are intrinsically unsafe. The interpretation of the requirements of the CPB in many aspects has been debated for a number of years, and in the context of GMOs, there are differing attitudes among scientists about the relevance of a potential risk, the criteria for evidence of harm, and whether to take steps to prevent that harm (Myhr and Traavik, 1999). In response, Mayer and Stirling (2002, p. 57) find that key characteristics of a precautionary appraisal system should include; "humility, completeness, assessing benefits and justifications,

making comparisons, allowing for public participation, transparency, diversity, and the 'mapping' of alternative views rather than the prescription of single solutions."

A frequently cited critique of the PP is that there is no precise definition and the language used is too vague to provide a basis for its effective implementation. This is evident in South Africa's National Environmental Management Amendment Act (2004), which provides the underlying framework for environmental law in South Africa. It requires that "that a risk-averse and cautious approach [be] applied, which takes into account the limits of current knowledge about the consequences of decisions and actions". It further states "that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied". However, the tangible and practical application of the PP is still not outlined, making it difficult to enforce.

In light of this, South Africa has never established its own criteria for what a precautionary approach would look like in practical terms. This is so despite the inclusion of the PP in the CBP, to which South Africa is a signatory (Mayet 2007, Prince and Black 2010). South Africa's on-going lack of compliance with the CPB has been criticised by The African Centre for Biodiversity (ACB) who filed a complaint with the Compliance Committee of the CPB in 2009, about the refusal of the South African government to respect its responsibilities under the protocol (ACB 2009). The lack of a clear definition of the PP, paired with an absence of impetus by the South African government to promote a precautionary approach of its own accord, creates a situation where it has become too easy to present evaluation processes as precautionary and thus to disregard real PP measures that involve the adoption of long-term, holistic and inclusive perspectives in environmental protection (Mayer and Stirling 2002). This confusion is evident in the draft Biosafety Policy (DAFF 2005) where it describes that;

> *"Although the precautionary principle has been reflected in a number of international agreements, countries utilize different formulations and differences remain as to the proper scope of application of the principle and its practical implications. The precautionary principle has also potential to cause conflicts with international trade rules. Bearing this in mind, following a pure precautionary principle is not recommended. However, it should be noted that elements of precaution are still essential and should be incorporated into the coherent approach."*

The relation of the PP to science-based risk assessment has caused significant controversy; in particular, the meaning of the principle, its scope, and its application have raised debates. Some observers have expressed that advocating for action without waiting for definitive science-based answers deviates from science and as a result stifles scientific and technological discovery (Holm and Harris 1999). Others have responded to this criticism saying that "value assumptions embedded in a scientific-risk framework may be a barrier for employment of the PP and that the governance of GM crops that are justifiable from a precautionary and ethical point of view must transcend traditional scientific boundaries to include alternative scientific perspectives as well as public involvement" (Myhr and Traavik 2003, p. 227). Stirling (2007, p. 10) states that, for all their strengths under strict conditions of 'risk', scientific techniques employed for risk assessment are "neither rational and rigorous nor practically robust under conditions of uncertainty, ambiguity, and ignorance". He goes on to suggest that on this basis, we must "see the value of the precautionary principle, as a salutary spur to greater humility" (Stirling 2007, p. 10).

2.2 PHILOSOPHY OF SCIENCE-BASED RISK ASSESSMENT

As has been shown, the risk assessment and subsequent regulatory procedures associated with the safety of GM crops have exacerbated controversy on a global scale, as well as in South Africa. As a result of this confusion, theorists are beginning to interrogate the approach to risk assessment and its underlying assumptions. The next section aims to give an understanding of what constitutes a risk assessment, provide an insight into its philosophical roots and give a general outline of the perceived problems associated with such an approach.

Positivism, The Failed Promise of Modern Science

Risk assessment constitutes a large part of the wider risk analysis framework. This is due to risk assessment's heavy reliance on scientific inquiry. Regulators are pressured to ensure that risk assessment decisions are soundly science-based (Carr and Levidow, 2000) and therefore scientists are called upon to satisfy the regulators' need with reliable methods of detecting, measuring and representing risks to human health and the environment (Jasanoff, 1999). But how has the apparently cult-like following of scientific inquiry emerged and why is it important to interrogate this approach in the context of GM crop risk assessment?

Habermas (1967) provides an appropriate point of entry from which to analyse the effects on society of the rise of what he describes as positivist science (positivism taken to be the belief that knowledge is characterised in terms of general laws, empirical testing, prediction and control, and value neutrality). His analysis begins with a conceptual division of human behaviour: work (purposive-rational action) and interaction (communicative action). The former is characterised by rational choice, governed by technical rules which determine the means to realise predetermined goals or values, acquired through learning skills in order to solve problems and based on empirical propositions tested by success or failure in the world. The latter is concerned with symbolic interactions between people, governed by consensual norms and expectations expressed in intersubjective languages, acquired through the internalisation of role expectations. In historical terms, traditional, pre-capitalist societies were largely communicative and gained their legitimation from mythical or religious interpretations of reality. However, "the dawn of capitalism created an economic subsystem that would need to guarantee self-sustained economic growth and this led to the need for new legitimations compatible with the rationale of the economic system" (Mingers, 1980, p. 42). It is these legitimations which Habermas sees positivist science as supplying.

In this sense, science for the first time became intimately tied to technology and production, which Habermas (1968) suggests has led to the irrefutable status that the scientific model of purposive-rational action now holds in society. Rationality and reason became synonymous with scientific knowledge: only questions capable of being considered in this empiricist-analytic form could be attempted and the explicit rejection of value judgements in the interests of objectivity meant that it limited itself to technical questions leaving practical questions of communicative nature detached from scientific thinking (Descartes 1637). This assumptive merging of rationality and science has led to a situation in which science is supposedly totally independent of all values, and questions concerning norms and values cannot be answered rationally but are to be merely *decided* upon in some arbitrary manner, at which point science can step in and specify the most efficient way of achieving the desired goals. As (Habermas, 1967, p. 265) remarks: "action still demands orientation as it did before. But now it is dissected into a rational implementation of techniques and an irrational choice of so-called value systems. The price paid for economy in the selection of means is a decision set wholly free in the selection of the highest-level goals".

However, Habermas (1967) suggests that the notion that science and rationality is entirely value free cannot be sustained. "The choice to combat dogmatism with rationality must, itself, either be justified rationally; in which case rationality is committed, or be itself dogmatic and acknowledge that rationality is a value" (Mingers 1980, p. 42). More recently, academics are beginning to interrogate risk assessment on these grounds, due to its complete dependence on the scientific method. Beyond rationality, proponents of the scientific method value how the system provides efficient means of reaching particular ends, and thus, efficiency has come to be a value in itself. Yet there is a systemic refusal to acknowledge that efficiency is a value system precisely due to its synonymous identification with objectivity and rationality - to act rationally is to act efficiently. This is the model which Habermas sees society applying to itself and this concept of rationality "ultimately implies an entire organisation of society: one in which a technology becomes autonomous and dictates a value system – namely, its own – to the dominant of praxis it has usurped – and all in the name of value freedom" (Habermas 1973, p. 270).

Scientists across many disciplines are increasingly questioning the process of risk assessment and the 'sound science' behind it. This divide occurring across academic lines is unearthing virtues of scientific discovery that science itself proudly claims to be devoid of – values and subjectivity. More recently, with food safety catastrophes such as BSE[15] and melamine[16], critics are beginning to shed light on and question the validity of the scientific nature of risk assessment, an approach that many academics are saying is inadequate to assess the true nature of risk and safety. A key criticism, as mentioned by Habermas (1968, 1973) is that scientific inquiry is in fact, subjective, value-laden, implicitly ethical, does not represent a neutral reading of reality and does not flow deterministically from conditions fixed by nature (Carr and Levidow 2000, Groves 2009, Jasanoff 1999, Krohn and Weyer 1994, Stirling 1998). The rise of positivism, Habermas (1967) suggests, has led to a condition in which rationality can only answer our technical questions through control and manipulation. Practical questions (of a communicative and ethical nature) are either suppressed or transformed into questions with purely technical answers. Yet, it has been suggested by Carr and

[15] "Bovine Spongiform Encephalopathy (BSE) in cattle first became a European in the 1980s and later a global animal health and food safety crisis with major implications for the trade and export of animals and derived products. Research suggests that the source of this disease was cattle feed prepared from BSE-infected animal tissues. The infectious which causes BSE in cattle can be transmitted to humans through consumption of contaminated meat" (EFSA 2012)

[16] "Melamine contamination in food first became a food safety issue when the chemical was detected in pet foods linked to kidney failure in thousands of dogs and cats in North America in 2007". An investigation into the incident found that melamine and its analog cyanuric acid were present in wheat gluten and rice protein concentrate imported from China by a pet food producer using it as a thickening and binding ingredient (Food Safety Watch 2013).

Levidow (2000, p. 29) that at root, "all environmental controversies involve disputes about fundamental ethical principles".

Soft Systems Theory (Checkland and Scholes, 1999) holds that since individuals each have a unique background of experience and knowledge, everyone brings their own perspective to a problem (based on beliefs, assumptions, and values) that is significantly different, yet equally valid. In this way, individuals may perceive the same situation differently. This suggests that, when making complex decisions that involve uncertainty, certain individuals will focus on certain things and ignore others. Carr and Levidow (2000, p. 33) say that in systems terms, "people differ in where they place the boundary between the system of interest and its context, or environment". The assigning of boundaries may be a conscious choice - to manage and simplify complexity, or it may be unconscious, based on an assumption that everyone shares the same view. This has a significant effect on the outcome of decisions because, in a regulatory context, it could determine whose expertise is considered relevant to the decision.

Risk Assessment and Risk Analysis, Conceptual Divides

According to Johnson *et al.* (2007, p. 1) risk assessment is "the evaluation of risk including the identification of the attendant uncertainties, of the likelihood and severity of an adverse effect(s) or event(s) occurring to [hu]man[s] or the environment following exposure under defined conditions to a risk source(s)." A risk assessment compromises hazard identification, hazard characterisation, exposure assessment and risk characterisation. Figure 3 refers to the variation in terminology used to describe methodological components common to many (but not all) risk assessment frameworks (Hill 2005). Subsequent risk management methods are used to reduce the scientifically identified risk (Myhr and Traavik 2002).

Biosafety South Africa is a national technology platform in service of the country's biotechnology regulators, researchers, technology developers and public. Their mandate is to enable safe, sustainable and compliant research, development, production, use and application of biotechnology - in particular GMOs. They declare, "A comprehensive risk analysis is the basis of all regulatory activities associated with GMOs" (Biosafety South Africa 2014). Figure 2 demonstrates how **Risk Analysis** is composed of a scientific-based **Risk Assessment**, **Risk Management** practices that are implemented through government policies and processes of **Risk Communication.** Risk

communication is one of the primary objectives of Biosafety South Africa and they declare, "biosafety issues should be communicated with care, based purely on science" (Biosafety South Africa 2014). They are a national biosafety service platform that is funded by the Department of Technology and are positioned between developers and the regulators, which raises questions about their positionality and perspectives.

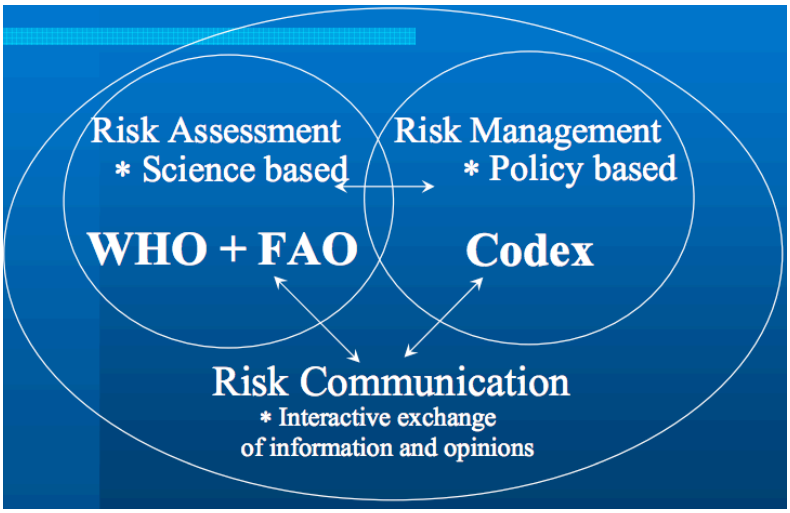


Figure 2, Components of Risk Analysis (WHO 2005)

Freudenberg (1988, p. 44) states "risk assessment is commonly seen as the domain of physical and biological sciences, with social scientists focusing instead on risk management and communication", a division that is unnecessary, and can lead to errors in risk assessments. Many criticisms have been directed at the current regulations for GM crops (Levidow and Carr 2000, Sjoeberg 2001, Mayer and Stirling 2002), some of which include their independence, suitability for decision-making regarding applications, the range of risks assessed and the legitimacy of the science behind the assessessment of those risks (Peterson *et al* 2000, Conner, Glare and Nap 2003). Opponents of the existing regulations have suggested alternative methods, including; widening regulation for a more holistic approach to addressing risk, so that risks beyond human and environmental are assessed, but also socio-political, ethical and economic concerns. There are also often calls to broaden expert panels to include non-experts to the committees who evaluate applications and advise on decisions for permits (Wallis *et al* 2005, Sjoeberg 2001, Poortinga 2005). Johnson *et al* (2007, p. 3) aim to demonstrate that these concerns are valid but essentially arise from confusion between what should and shouldn't be included in a risk assessment, which is a "pure science [that] should test hypotheses and make predictions from the results of those tests." They suggest that anything non-scientific that

addresses 'social concerns' lies outside of risk assessment and more appropriately within the wider risk analysis. The following section seeks to address what specific problems have been raised by academics working within the field of GMOs, philosophy of science and risk.

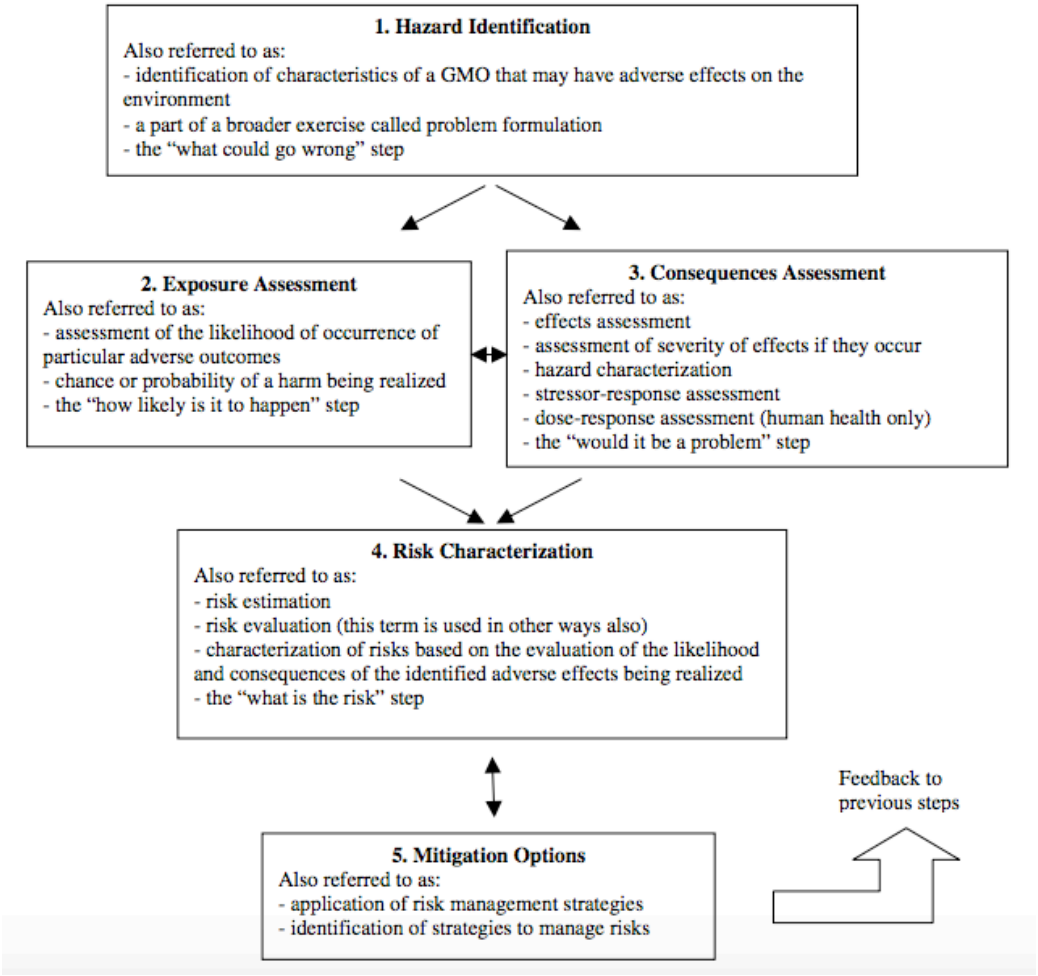


Figure 3. Stages of a Risk Assessment and Alternative Terminologies (Hill 2005)

Substantial Equivalence

In food safety, the principle of substantial equivalence (PSE) holds that the safety of a new food, particularly one that has been genetically modified, may be assessed by comparing it with a similar traditional food that has proven safe in normal use over time (OECD 1993). Critiques of the principle of substantial equivalence (PSE) articulated particularly by Eric Millstone and collaborators (1995, p. 1), focus on the assumption that if a "GM food can be characterized as substantially equivalent [in chemical terms] to its 'natural' antecedent, it can be assumed to pose no new health risks and hence to be acceptable for commercial use." This approach may seem reasonable and appealingly benign, yet many critics believe that it is careless, un-scientific, and should be discarded in exchange of an appraisal that includes biological, toxicological and immunological tests rather than just chemical ones. The adoption of the PSE by governments of industrialised countries, seemed to indicate to the GM food industry that "as long as corporations did not try to market GM foods that had very different chemical composition from those foods already on the market, their new GM products would be accepted without any safety or toxicology testing" (Millstone, Brunner and Mayer 1995, p. 525). It will be noted here that South Africa embraces the PSE and forms the basis for the safety assessment of GM crops.

Unfortunately, scientists cannot yet predict the biochemical or toxicological effects of a GM food from knowledge of its chemical composition. A study conducted by the National Institute for Quality Control of Agricultural Products (RIKILT, 1998, p. x) in the Netherlands found that; "comparisons of relatively crude compositional data provide a very weak screen against the introduction of novel genetic, biochemical, immunological or toxicological hazards" and have therefore suggested "a finer-grained screen test for differences in some of the relevant biological variables such as DNA analysis, messenger-RNA fingerprinting, protein fingerprinting, secondary metabolite profiling and in vitro toxicity testing." It must be noted that the Food and Drug Administration (FDA) of the US has never approved any GM food as *safe* but has instead deregulated the assessment, proclaiming them to be *substantially equivalent* to their non-GM counterparts. This decision was recognised as an expedient political decision and not scientifically based. Arguably more controversial, "the FDA ignored warnings by its own scientists that GM is different from traditional breeding techniques and poses

unique risks to human and animal health" (Bizzarri 2012, p. 150). Additionally, the PSE indicates that GM foods are in some ways novel, but in others are not novel at all – "just marginal extensions of traditional techniques" (Millstone, Brunner and Mayer 1995, p. 525). The ambiguity of the principle leaves it susceptible to interpretation and thus easily manipulated by its proponents. These contradictions are expected, given that the entire system of GM crops is based on the premise that GM foods are sufficiently novel that they require new legislation and an extensive overhaul of the regulations that govern intellectual property rights (IPRs) to enforce patenting, yet not so novel that they could introduce new risks to environmental or human health (Millstone, Brunner and Mayer 1995).

Uncertainty and Unpredictability

Other concerns that have been raised like the unintended ecological effects are associated with uncertainty and unpredictability (Stirling 2010, Preston and Wickson 2016, Wynne 1992). One intrinsic problem with the use of risk assessment as the dominant approach in appraising emerging biotechnologies is that the risks these technologies pose are novel, leaving them poorly understood, and therefore requiring the development of new testing methods in order to generate the empirical data necessary for such an assessment. The inadequacy of existing empirical data makes it hard to foresee potential harms with any certainty in advance. "This limitation intensifies when harms are non-linear, incremental, emergent, and (sometimes) enduring" (Preston and Wickson 2016, p. 49). Even when experts acknowledge uncertainty, it is done so in a way that reduces unknowns to measurable 'risk'. As a result, policy-makers are urged to both pursue and claim 'science-based' decisions when in fact, the uncertainties surrounding emerging biotechnologies can exist in both quantitative and qualitative forms. An over reliance on quantitative forms of risk is thus insufficient to respond to incomplete knowledge. It leaves scientific advice

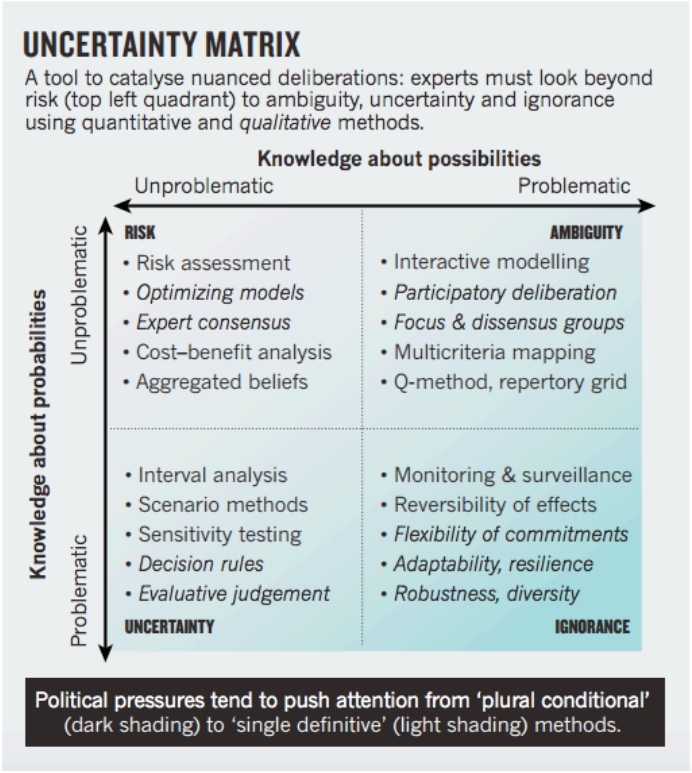


Figure 4. Uncertainty Matrix (Stirling 2010)

vulnerable to the social dynamics of dominant groups and "manipulation by political pressures seeking legitimacy" (Stirling 2010, p. 1029). Further, Stirling argues that a preoccupation with assessing risk means that policy-makers are denied exposure to opposing interpretations and the possibility of surprise. Some uncertainties will emerge from a simple lack of knowledge and may be reduced over time, while others will be more systemically embedded, "stemming from the inherent limitations of scientific knowledge that fail to understand complex systems and the framing choices scientists make in the planning and execution of their research" (Wickson, Gillund and Myhr 2010, p. 452). The issue of framing research in particular ways echoes a systems theory analysis where decision-making that involves uncertainty implies that by focussing on one thing, other issues are ignored. Figure 4 shows that practical quantitative and qualitative methods do exist to combat other elements of doubt (such as ambiguity, uncertainty and ignorance) that are inherent in releasing GMOs into the environment. Yet, framing problems only in terms of risk means that methods to address these doubts essentially become invisible and thus unexplored.

Hoffmann-Riem and Wynne (2002, p. 123) state "that uncertainty can be explicitly stated and reduced by reproducible experiments under controlled conditions". Bizzarri (2012, p. 167) emphasises the feature of 'controlled conditions' by stating that only if "the exact site of DNA insertion, the function of the transduced segments and their involvement in the host metabolic processes are also known" can unintended consequences be partly predicted. However, the sphere of ignorance (Figure 4), generally understood as the interaction between unknown processes and/or state variables tends to be implicitly neglected in risk assessment, precisely because political pressures encourage 'single definitive' methods rather than 'plural conditional' methods (Stirling 2010). In order to overcome confusion by scientists, policymakers and the public, it is important for everyone involved to acknowledge that "unanticipated effects of novel technologies are not just possible but probable and that potential harmful consequences cannot be reliably be established by further research since they fall into the domain of ignorance" (Hoffmann-Riem and Wynne 2002, p. 123). The regulation of risk must emphasise the limits of knowledge, rather than seeking to prove existing knowledge to be correct.

Reductionism

The reduction of complex ecological systems and interactions into deceptively predictable expressions of single genes is another concern that has been consistently raised (McAffee 2003,

Perlas 1995, Prescott *et al* 2005). Many agro-biotechnology companies market their products using the promise of abundance from intricate molecular manipulation of staple food crops. But claiming that humans now possess the power to control life forms on the genetic level for our benefit, McAffee (2003, p. 203) is based on a "deceptive form of molecular-genetic reductionism which uses out-dated notions of 'genes' and 'genetic codes', [disregarding] the interactions among molecules, organisms, their environments, and their social settings." The African Centre for Biodiversity (ACB) in their objection to Monsanto's application for an extension permit of drought tolerant maize criticised the use of GRAS (Generally Recognised as Safe) which exempts products from regulatory testing. ACB (2015, p. 9) suggest, "These guidelines rely on the reductionist assumption that a protein that is safely consumed in its natural context is automatically safe in a new, artificial context i.e. under the control of a synthetic transgene, in a new location of a genome, within the genome of a different species. Predictions of safety based on the similarity between protein sequences are not sufficient to determine the lack of allergenicity/toxicity of a trans-protein."

This reductionist discourse, in turn, supports economic-reductionist arguments that genetic information must be patentable and that biotechnology managed by the market will benefit everyone, which further extends "the commodity realm to the molecular level" (McAffee 2003, p. 204). This discourse perceives genetic resources and transgenic products as typical, tradable components of production under international intellectual property systems and fortifies certain intentions to regulate biotechnology under the World Trade Organization (WTO). This approach regards nature and its complex intricacies as conceptually quantifiable and separate from their contexts, living in nature and in society, whilst masking the effects of political, cultural, and ecological factors on market transactions and resource values (McAffee 2003).

Alternatives

The main argument put forward in O'Brien (2000) - "Making Better Environmental Decisions: An Alternative to Risk Assessment" is that currently, the approach to environmental decision-making that is informed by science-based risk assessment, focuses on how much harm can be endured rather than avoided, a method that she sees as scientifically impossible, immoral, and damaging to democracy. Risk assessment is not concerned with viable alternatives to the risk that is being assessed. O'Brien states that instead, moral decision-making should give priority to "least-harm alternatives that are most beneficial for the environment and for the public interest" (p. 80). In

addition, Stirling and Mayer (2001), in their paper that looks at 'Multi-Criteria Mapping' as a novel approach to the appraisal of GM crops, provide a similar critique of a science-based risk approach to assessment, which they say is limited to only evaluating individual options on a case-by case basis, which marginalises the consideration of different strategic alternatives to the use of GM technologies (p. 550).

Broadening the Lens

Although risk assessment techniques continue to offer essential tools in addressing specific aspects of safety and risk, Mayer and Stirling (2002, p. 69) state "there seems to be no compelling theoretical, methodological, or practical reasons for persisting in basing the entire regulatory appraisal on these inherently constrained and limited methods". As Poteau (2000, pp. 273 - 291) succinctly states; "food quality cannot be restricted to a mere substance and food acts on human beings not only at the level of nutrition but also through their relationship to the environment and society ... food products also mean processes. The content of food is more than its chemical composition and in the case of GM food, the public debate reaches far beyond risk assessment ... Context, the often-forgotten factor when dealing with living processes, from genetics to human activities, needs to be re-introduced by considering these other aspects."

It is this conceptual and practical rift, in the fracturing image of both risk assessment and risk analysis that a feminist ethic of care offers a more satisfying and valuable lens through which to view the assessment process of GM crops. A feminist ethic of care asks us to move away from a consequentialist-based framework of assessment, with its origin in positivist science and instead, move towards a more holistic framework. Such an approach would broaden the scope of what constitutes risk and acknowledge the complexities present in ecological, environmental and social interactions in the context of GM crops. Just as in the case of other technologies, GM crops do not exist in isolation, but function as part of socio-technical and eco-social systems. "They are shaped by the interests, values, goals, and visions that arise from their contexts of development and deployment and, at the same time, they themselves shape operating discourses, social practices, skills and knowledge" (Preston and Wickson 2016, p. 50). Care, by offering up an awareness of the diversity of values that are constitutive of a meaningful life, connects us to a future of care. Thus, providing us with "ethical resources that can guide us in the face of uncertainty" (Groves 2009, p. 17). "By narrowing regulatory considerations to an assessment of empirically observable risks to human and

environmental health, the appraisal process has failed to see GM technologies as part of an agri-food system and has thereby failed to account for the complex networks of interrelation and co-construction this entails" (Preston and Wickson 2016, p. 50). The next section explores the potential of a feminist ethic of care as forming the basis for an alternative paradigm for GM crop assessment as opposed to dominant moral theories that inform the current risk-based mode of assessment.

2.3 FEMINIST ETHICS OF CARE

An Ethic of Care as Response to Dominant Moral Theory

A feminist ethics of care, through its central themes of importance (Table 2) brings to light a different set of issues concerned with acknowledging the shortcomings of dominant moral theories (Engster and Hamington 2015). Noddings (2002) refers to its timely unfolding as an important alternative to 'politics as usual', forcing a reconsideration of new and pressing issues that are confronting us in our diverse and globalised world. A care approach is not just a new set of values to be placed on our geopolitical context. Rather, care alters the moral landscape in both understanding the particular issue at hand and formulating the appropriate, ethical response. Starting from a place of care forces us to consider both how issues of care lie behind contemporary problems and how we can better address these problems by providing better care for all (Engster and Hammington 2015). Held (2006, p. 3) posits that an ethic of care is changing the way moral problems are often interpreted and changing what many think the advocated approaches to moral issues might be. "From the outlines of egalitarian families and workplaces, to the moral responsibilities of parents and citizens, to the ethical evaluations of governmental and foreign policies, the ethics of care optimistically provides hope for altering the way in which society thinks about how best to navigate our lives."

There are many scholars who define care ethics in different ways and place emphasis on different aspects of the framework. Some proponents resist the generalisation of 'fitting it into' a form of moral theory and would rather see it as a 'mosaic of insights' (Held 2006, p. 9), placing value on its sensitivity to contextual nuance and particular narratives, rather than making abstract claims of more familiar moral theories. Care theorists unite over the value of these themes (Table 2) in contrast to dominant moral theory (Kantian ethics and utilitarianism as rationalistic moral theories of justice). Robinson (2011, p. 129) sets out the characteristics of a critical, feminist ethics of care, focusing

particularly on distinguishing this approach from traditional rights based, universalist, and impartial views of ethics. Her account seeks to explain why care ethics must be both feminist and critical if it is to provide a normative framework that is ultimately transformative of existing, oppressive relations of gender and race in the global political economy.

Firstly, the ethics of care is concerned with the **relational vision** of the person - as involved in a set of bonds, which constitutively determine their actions and choices. This is in contrast to Kantian-inspired theories that promote the idea of an independent and self-sufficient individual, moved exclusively by selfish passions, deemed necessary to respond with rational, universalistic and abstract moral rules that neutralise conflict and re-establish a condition of impartiality (Pulcini 2012, p. 226). Care theorists propose that autonomy must be understood as relational, social in nature, contingent or processual, and exercised in practice (Gouws and van Zyl 2015). Code (1987) states that we are 'second persons' – always partly constituted by the relationships we are involved in.

Secondly, **context matters**. Unlike traditional abstract and universal Western theories of ethics, which are concerned with the universal, impartial judgements, rights and obligations, a care ethic **values particularism**. Therefore, a focus is given to attention, responsiveness, and responsibility, to the needs of 'concrete others', not the 'generalised other' (Benhabib 1986). Subsequently, to respond authentically, care must be unique and individualised. However, although Robinson (2011) addresses the need for a commitment to address moral problems in the historical and social context of real, lived experiences, feminist care ethics as an approach avoids far reaching critiques of colonialism and developmentalism, of which this study asserts are fundamental to re-imagining agricultural governance in a post-colonial, post-apartheid state.

Thirdly, Fraser (1987) and Tronto (1993) emphasize the inherent difference in **power** relations found in discussions of social policy. Those making policy are usually in positions of some authority whilst those in need of care, have significantly less power to change their situation. Often, even the vocabulary and grammar of the two groups are markedly different. This power difference frequently works to keep the powerful in power, using expert language to legitimise the system of power, which they benefit from. Therefore, care theorists state the need to develop an appropriate vocabulary at the level of caring-about, to exercise receptivity and keep the conversation open (Noddings 2002). Gouws and van Zyl (2015) see that an analysis of care must address how power is deployed between

people in their everyday lives, as well as how care is integrated into relationships between groups of citizens and citizens and the state.

Table 2. Comparing themes from a feminist ethics of care to dominant moral theories (Preston and Wickson 2016, Held 2006, Robinson 2011)

Feminist Ethics of Care	Dominant Moral Theory
Relational Ontology	*Autonomous Ontology*
Conceptualizes selves as fully relational, existing in and through complex, constitutive relations with others.	Individuals conceived as isolated, self-reliant, moral selves.
Particularity and Context	*Universalism*
A commitment to addressing moral problems in the socio-historical context of real, lived experiences.	Universal principles and rules, with impartial judgements with rights and obligations, with interests of the self against interests of the all.
Power and Vulnerability	*Equality*
Acknowledgment of structural injustices that systematically pervade society, privileging some, whilst marginalizing others.	Assumes each person involved in society to be a free and equal agent.
Narrative	*Abstraction*
A useful tool that can be employed to highlight issues often lost or underplayed in mainstream philosophical ethics. Can illuminate power considerations by providing room for the voice of those who might ordinarily be excluded.	Conceptual order achieved by answering moral questions through rational deduction from abstract rules that neutralise conflict and re-establish a condition of impartiality.
Emotion	*Rationality*
Values emotions as informative and motivating moral tools. Responses to situations need not exclusively focus on reason. Action may be legitimately motivated by the affective demands of a situation.	The actions of individuals are based purely on rational calculation of costs and benefits. Rationality ensures impartiality, which is necessary to achieve responsible moral judgement.
Public/Private	*Public/Private*
Rethinking nature of 'public' and 'private'. Challenging what counts as 'political' and how these assumptions are constituted through historically constructed gender norms, roles, and power relations.	'Public' has relevance for more theory in a way that the 'private' does not. Care only matters in the context of the intimate, personal relationships and is irrelevant, even dangerous in the 'real' context of ethics - that takes place in the 'public' realm.

Warren (1990, p. 134) suggests that **narrative** is a useful tool that can be employed to highlight issues "often lost or underplayed in mainstream philosophical ethics". Narratives can illuminate power imbalances by allowing room for the voices of the marginalised, or for those who may not be part of the dominant majority and as a result, may be vulnerable to transformational change (Preston and Wickson 2016, p. 55).

A key feature that is extensively drawn upon by care ethicists is the **affective dimensions** of moral experience. Before, where ethics have been characterised as principally rational and constructed individually, a feminist ethics of care encourages an appreciation that moral decision-making has a significant emotional core (Held 2006, Preston and Wickson 2016). A care ethics **values emotions** rather than rejects them as a valid form of knowledge - sympathy, empathy, sensitivity, and responsiveness are seen as moral emotions that play a vital role in caring for the other. Noddings (2015) traces the centrality of emotion or feeling in moral life back to David Hume (1711–1776) who emphasised the role of feelings in moral motivation - to be motivated to act we must *feel* something.

Finally, like much feminist thought, a care ethics calls for a re-conceptualisation of the traditional notions about **the public** and **the private**. It was formerly imagined that conceptual order could be achieved by a radical separation of public and private. Held (1995) points out that the public has relevance for moral theory in a way that the private does not. The way in which the activities of women have been kept in the private sphere can thus account for much of the oversight of the experience of women in moral theorising, with care theorists now seeking to overhaul this distinction. In conclusion, what binds care theories together is not a dogmatic commitment to a singular understanding of the theory, but a more general advocacy of a number of major themes. See Table 2.

Feminist Perspectives on Science

The overview of a feminist ethics of care is strengthened by looking at feminist perspectives on science and scientific research due to their parallel interests in providing a counter narrative to dominant, masculinised theories. A feminist ethics of care seeks to respond to Kantian inspired theories of morality and justice, while feminist perspectives on science examine and critique Enlightenment scientific philosophy and practice. There are benefits from bringing together both perspectives: by exploring the fluid boundary that exists between science and morality, a more

holistic understanding of the philosophical framework behind science-based risk assessment can be communicated.

Carol Gilligan, one of the first scholars to theorise a care ethic, in her preliminary work – 'Feminist Care Ethics: In A Different Voice' (1982) seeks to criticise the traditional psychological tradition that suggests women are morally inferior. She specifically examines the methods of educational psychologist, Lawrence Kohlberg (1927-1987)[17], stating that his methodologies are male-biased and "its ears [are] tuned to male, not female voices" (Gilligan 1982, p. 2). Feminist perspectives on science call into question presuppositions about the nature of human beings, about the efficacy of positivist and post-positivist research models, and about the relationship of knower to known, and seek to propose alternative ways to define, create, and assess human knowledge (Preissle 2006, p. 516).

Harding (2006, p. 80) provides an effective point of entry by confidently expressing the absurdity of the claim by proponents of the scientific academy, that if the methods of the natural sciences are properly used, they will ensure value-free research. She goes onto explain how feminist research undermines the assumptions of science in two major ways: (1) conventional standards for objectivity - rationality and 'sound science' are incompetent to detect sexist and androcentric values as interests; and (2) scientific standards themselves are already actively politically engaged, whether or not those who support such standards intend the particular politics that the standards promote. She elaborates by saying that if science and their philosophies cannot recognise how scientific practices themselves inadvertently legitimate and further disseminate political and cultural values and interests, they usually end up complicit with the agendas of dominant social groups (Harding 2006, p. 93).

To further this analysis, the work of Barad (1998) and Rouse (2004) look at the social construction of scientific knowledge, and seek to demonstrate how culture and politics become habitually intertwined with scientific research, and how these factors escape into the everyday world through scientific practices. In light of this, they state the importance of applying a politics of responsibility and accountability. This aims to uncover partiality and subjectivity, concerns that are assumed to be

[17]Lawrence Kohlberg (1969) created a universal model to explain moral development. The scale was derived from extensive case analyses and two-hour interviews with boys ranging from 10 to 16 years. Kohlberg presented them with hypothetical abstract moral dilemmas where obedience to law and rules or commands of authority conflict with the needs of other persons (Kohlberg & Kramer, 1969).

adequately monitored by objective research methods that claim to eliminate social values and interest from the research. Kollek (1990, p. 96) looks at the limits of experimental knowledge, critiquing the methodological rules and standardised practices that are designed to optimise the process of reality perception and states that "by defining the sphere that can be perceived by scientific means, the phenomena that are relevant to the scientist are also implicitly defined." Descartes (1637) prescribed that only those objects or phenomena that can be approached by scientific means should be subjected to scientific inquiry. This rule defines the domain of scientific inquiry. Phenomena, which cannot be approached or examined by scientific methods are not recognised as a legitimate field where knowledge can be acquired.

Levidow (1995, p. 175) demonstrates how differing perceptions of how scientific knowledge is made stems from tensions between recognised social values and the unstated values embedded in scientific development and technical possibilities. In the context of GMOs, Levidow (1995) argues that conflicting accounts of risk draw upon different cognitive and ethical frameworks. For many proponents, biotechnology will help agriculture to 'feed the world' in the shadow of Malthusian crisis whilst minimising pollution. It is through these humanitarian and environmental images that the biotechnology industry seeks ethical legitimacy for its efforts to obtain state subsidies and minimise regulatory constraints – in particular, to treat GMOs as a benign technological development; "its environmentally friendly products will overcome the limits of chemical-intensive agriculture, keep agriculture secure from environmental threats and fulfil nature's cornucopian potential" (Levidow 1995, p. 177). On the other hand, some critics of biotechnology (Shiva 1993) have refuted GMOs on fundamentalist terms, stating that tampering with genes runs against 'the spirit of nature'. Other critics (Altieri 2001, Bizzarri 2012, Perlas 1995) state the damage of single-gene solutions to problems that stem from intensive mono-cropping systems. What these instances demonstrate is how the risk debate simultaneously provides an informal technology assessment and an informal ethical debate on the values that drive research and development. It is upon this evaluation that frames how we conceptualise clear risks and benefits. Levidow (1995, p. 179), asks the question; "how then, do these value conflicts bear upon regulatory agendas?"

By understanding the relationship between dominant theories of ethics and science, we begin to learn that these spheres of knowledge and experience are not as separate and distinct from one another as their proponents would suggest. Feminist perspectives provide us with new 'ways of seeing' risk; not simply as an objective, quantifiable statistic, independent of value, time and space,

but, as Latour (1991) would suggest - as a form of 'quasi-object', an intersection of forces, objects and agents (Latour 1991, p. 10). Indeed, feminist perspectives ask us to 'look around' the usual determinations of risk and 'look at' the nodes of intersection and proliferation that exist with our own value systems. Risk may be viewed as an expression, rather than an origin. Feminist perspectives suggest there is 'a way to' risk that is non-linear, indirect, derives from no single origin, and traverses our moral landscape.

2.4 SUMMARY

Chapter two has provided the theoretical basis upon which the research took place. By investigating the epistemology of science-based risk assessment and looking into feminist perspectives on science and technology, a counter narrative begins to emerge. The next chapter draws upon the theoretical foundation that as laid out in the literature review to provide an insight into the methodologies that were used for this research.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3. 1 INTRODUCTION

This chapter will begin by giving an overview of the research paradigm and the ways in which it complements this specific project; followed by an in-depth description of the practicalities of the research. The chapter will end with some reflections on the research process and some limitations of the methodologies that were chosen.

The appropriate methods were chosen according to the specific objectives. The next section will give an overview of the research paradigm - 'Pragmatism', which was selected because it allows for the practical selection of methods that may best achieve the research aims and objectives. A mixed approach to the research was adopted. This is because one of the key research objectives is to apply and examine a theoretical framework – a feminist ethics of care in the context of GM crops. At the same time however, in order to assess the framework's suitability, new perspectives must be given the space to emerge. Ali and Burley (1998, p12) suggest that qualitative research does not necessarily have to comply entirely with inductive approaches to research and demonstrate how researchers can use existing theory and simultaneously maximise the attention paid to the respondent's perspective. They state specifically researchers "seeking to use an inductivist/qualitative approach can start with an a priori specification of constructs, perhaps in the form of a model" (Ali and Burley 1998, p. 2). One of the ways this can help the researcher is to identify where they should look in order to find the phenomena of interest to them.

3. 2 FROM POSITIVISM TOWARDS FEMINIST PRAGMATISM

"Positivism has been displaced, or so we hope" (Lather and Lather 1991, p. vii). This is the first basic assumption of the research and calls forth the challenge to pursue possibilities in a post-positivist era. The notion that everything may be known through assumed impersonal norms and procedures of objective science is being displaced and this displacement of the monolithic narrative of positivism is allowing for multiple research pathways to emerge. Due to the explorative nature of this research and its associated qualitative methodology, a pragmatic research paradigm has been

employed as the most appropriate for achieving the research aims and objectives, benefits of which have been well documented by Biesta and Burbules (2003), James (1995, 1997) and Maxcy (2003). It is important to recognise that a pragmatic approach aligns itself well with feminist inquiry (Amrita 2008 and Dielman 2012, Lather and Lather 1991) as it utilizes and integrates core concepts of pragmatism, including its emphasis on pluralism, lived experience and public philosophy with feminist theory and practice, in order to engage in social issues (Whipps and Lake 2016). Further to this, contemporary intellectuals are working within a time that Foucault (2008) argues is noteworthy for its disturbing of the formerly secure foundations of our knowledge and understanding. As Smith and Heshusius (1986, p. 5) state, it is the end of the quest for a 'God's Eye' perspective and the confrontation of what Bernstein (2011) calls 'the Cartesian Anxiety', the lust for absolutes, for certainty in our ways of knowing and instead the start of emergences and awareness and representation of complexities; "of the contingent, messy, boundless, infinitely particular, and endlessly still to be explained" (Murdoch quoted in Spanos *et al* 1987, p. 370)

"Pragmatism recognises the existence and importance of the natural/physical world as well as the emergent social and psychological world that includes language, culture, human institutions, and subjective thoughts" (Johnson and Onwuegbuzie 2004, p. 18); in context, GM crops act as a node of interaction between the natural and human-psychological world. Further to this, pragmatism views knowledge as simultaneously constructed by reality and as an agent of reality construction. This reflexive and cyclical epistemology is reflective of the changing nature of knowledge in society, and is not only a fundamental tenet to the nature of this research but also an affirmative result. This approach also endorses the fallibility of knowledge, positing that current beliefs and research conclusions are rarely, if ever, viewed as perfect, certain or absolute, rather, conclusions are situated (England 1994).

3. 3 POSITIONALITY

The Enlightenment philosophy asserts that the subject is an autonomous individual, capable of full consciousness and endowed with a stable 'self' - constituted by a set of static characteristics such as sex, class, race, sexual orientation (Bowers 1987 in Lather and Lather 1991) in which the dialogues of detachment, distance, impartiality and the personal are reduced to mere nuisances or threats to objectivity (England 1994). Nevertheless, feminist and post-structural scholars are de-centering the subject and refashioning them as a site of disarray and conflict inscribed by multiple contestatory

discourses (Lather and Lather 1991, p. 6). In light of this, as a researcher, it is imperative to take ownership of one's positionality; a researcher feels, the participants feel, we reflect, we learn, we change our minds, we are non-linear, messy and have the ability to be untruthful: this unpredictability and unreliability simply exists. Having a preconception of the research that is influenced by values, worldviews and positionality may be viewed by proponents of positivist-quantitative research (Marshall 2001, Johnston 2000, as problematic, objectionable and serve as a limitation. Yet, within a feminist pragmatic paradigm, it is fundamental to acknowledge the messy, use the messy and analyse it and, with confidence, generate robust and rigorous research that can contribute to the breakdown of patriarchal research methodologies and knowledge production, events that are firmly well overdue.

With this in mind, it is important to note that this project is being undertaken due to the perceived problematic nature of current assessment of GM crops on a global scale. The current assessment methodology is reductive in its very nature due to its lineage in Enlightenment thought, manifested during the European Scientific Revolution of the 16th and 17th centuries. Therefore, an alternative approach is necessary in order to illuminate a diverse range of problems that are hidden beneath the reductionist approach to such assessment. A Feminist Ethics of Care is a potential alternative that will be proposed through this research, which could broaden the scope of assessment and encourage a more inclusive and democratic system of methodologies. This endeavour is evident in the main objective, which is to explore the potential of a feminist ethics of care as an alternative approach to GM crop assessment in South Africa.

A strict dichotomy between object and subject is emphasised by neo-positivist empiricism, as a prerequisite for objectivity. Such belief is supported by methodologies that "position the researcher as an omnipotent expert in control of both passive research subjects and the research process" (England 1994, p. 242). This paradigm assumes that the researcher holds the power in the researcher-participant relationship. For example, Stacey (1991, p. 114) argues that the researcher can "manipulate the researched through intrusion of privacy, breaking confidentiality, lack of interpretative space and authority and appropriation" over what she calls the 'dissonance' between fieldwork practice and 'ethnographic product'. Yet, hierarchical relationships like those outlined by Stacey (1991) do not always manifest in research. In fact, during this research process, the researcher, who is traditionally regarded as omnipotent and omniscient, was often rather more vulnerable than the participants. This could be due to differing levels of knowledge about the subject

between participants and the researcher. Equally, when interviewing men in positions of power, the sexual difference inherent in these relationships and the gendered actions that follow may have also contributed to the change in research relationship. As is evident here, neither the researcher nor the participants existed in fixed, stereotypical roles where only the researcher exercised power over the researched. Subsequently, research frameworks that exist around a neo-positivist research-participant relationship are of no use to research that challenges this notion.

Thapar-Bjokert and Henry (2004, p. 364) argue "feminist researchers reflecting on fieldwork should review the utility of models of power which constitute a rigid distinction between oppressor and oppressed and perhaps adopt a framework which imagines power as shifting, multiple and intersecting". Here, power is dispersed throughout the research relationships which disrupts the usual configuration power from the top. Understanding power in this less rigid way, a re-conceptualisation of these out-dated binary constructions of researched/powerless and researcher/powerful can take place.

3. 4 METHODS

Pragmatism was selected as the appropriate paradigm due to its ability to provide a philosophical framework that allows the research objectives to guide the choice of methodologies. The following methods were applied in order to achieve the research aims and objectives;

Participants

It was first necessary to understand who is involved in the regulation of GM crops in South Africa. Once this was done, specific contact information was sought out in order to gain contact for potential interviews. After mapping the various actors involved with GMOs in South Africa, contact was made with forty-five potential interview participants. Of the forty-five, seventeen interviews were organized within South Africa. Participants at the Genøk Centre for Biosafety in Tromsø, Norway were contacted because they have a strong and active interest in applicability of feminist ethics of care framework and have begun looking at its potential within the context of biotechnology (Preston and Wickson 2016, Wickson *et al* 2017). Further to this, participants working at SPRU (Science and Policy Research Unit) at the University of Sussex, UK were also contacted due to their extensive background in food policy and risk research. I am also an alumnus of Sussex University, which helped

with gaining access. Interview participants outside of South Africa were important for this research in order to situate it in a global context, as well as to provide points of comparison.

Initial contact was made by e-mail giving a brief overview of the research, why that specific individual would be useful to interview, accompanied by a Participant Information Sheet (see appendix 1) which contained the request for prior informed consent. If a response was not received within a week, another reminder e-mail was sent accompanied by a telephone call (if a number could be found). A list of the institutional affiliations can be found in appendix 2. Participants were grouped into three categories;

(1) Government Representatives
(2) Academics and Scientists
(3) Civil Society and NGOs.

Due to varying backgrounds and knowledges of the participants, it was not possible to ask the exact same set of questions to each participant: therefore, drawing upon feminist ethics of care literature (Preston and Wickson 2016, Groves 2009, Held 1995 & 2006, Robinson 2011, Tronto 2003, Code 1987), themes were deduced beforehand, on which the interview questions were based (Table 3). Generating the questions in this way allowed for different sets of knowledges to be qualitatively explored whilst maintaining a structured focus throughout the interview.

Table 3. Sensitising Concepts (Blumer 1969)

SCIENCE-BASED RISK ASSESSMENT	FEMINIST ETHICS OF CARE
Quantitative Dependence	Relational Ontology
Isolation/Reduction	Particularity and Context
Power	Power and Vulnerability
Objectivity and Singularity	Narrative and Voice
Rationality	Emotion
Public + Private	Public = Private

Interview Methods and Techniques

Twenty-two semi-structured interviews were carried out over a period of six weeks; each interview was recorded with prior informed consent and lasted an hour on average. Due to the relatively explorative nature of the research, semi-structured interviews were selected as the most appropriate type of interview to carry out in order to best achieve the research objectives. The objectives required that both the practicalities of the risk assessment process and the more abstract and emotional thoughts were asked about. Semi-structured interviews are useful to gather focused, qualitative textual data and offered a balance between the flexibility of an open-ended interview and the focus of a closed question survey. The researcher sets up the general structure beforehand but the participant being interviewed has a fair degree of freedom in what to talk about, how much to say, and how to express it (Drever 1995).

Three out of the twenty-two interviews took place over Skype because it was not possible to meet in person. Gall *et al* (1996) confirm that recording has more advantages over note taking alone because it reduces the tendency by the interviewers to unconsciously select data favouring their biases. It provides a complete verbal record and can be studied much more thoroughly than notes. The data collection and analysis took place both simultaneously and consecutively. After each interview, preliminary notes were taken. Note taking is the strategic selection of information that can be used to remember the scenario existing at the time in question (Muswazi and Nhamo 2013). In some settings, an observer taking notes on tablet or notebook may distract participants or disrupt the effectiveness of communication between the interviewer and the respondent: that is why preliminary notes were always taken after the interview had finished. All interviews were transcribed using transcribing technology (InqScribe©), which allowed for thorough textual analysis of the interviews. Further analysis of the preliminary notes with the addition of in-depth analysis through the 'reading and re-reading' of the interviews (Rice and Ezzy 1999) took place to form the basis of the thematic analysis.

Thematic Analysis

Thematic analysis is the search for themes that emerge as being important to the description of the phenomenon (Daly, Kellehear and Gliksman 1997). Throughout this research, a hybrid approach to thematic analysis was used. This method involved both a deductive qualitative approach to analysis, as

outlined by Crabtree and Miller (1999) whilst allowing for the effects of an inductive, data-driven approach to emerge (Boyatzis 1998). Theory-guided research uses research and theory, as a guide to focus a study and help illuminate what might be important (Gilgun 2015, p. 15): this allows for sensitising concepts to guide the research. Sensitising concepts, in the words of Blumer (1969, p. 669) "suggest directions along which to look" whilst carrying out data collection, analysis and interpretation. Inductive reasoning starts with the data from which patterns and regularities can formulate tentative themes which may be further explored. Table 3 shows the sensitizing concepts that were employed during the interview design, data collection and analysis. This hybrid approach complements the research objectives by allowing a feminist ethics of care framework to be examined in the context of GM crops assessment, whilst acknowledging themes that emerge directly from the data. This hybridity ultimately allows for a theory to be tested whilst retaining a degree of flexibility.

3. 5 LIMITATIONS

There are limitations to this research that must be recognised - both theoretical and practical. Firstly, an inductive approach to data analysis, like Glasser and Straus (1967) have pointed out may be impossible. Researchers' perceptions are never entirely objective but have many preconceptions, only some of which are in awareness. However, taking a less stringent definition of induction, asks the researcher to put aside their own perspectives, to listen and hear what the participants have to say without (as far as possible) projecting their own meaning onto what is said. In addition, deduction as an analytic process is historically more strongly associated with quantitative analysis and only more recently have scholars applied it in qualitative contexts (Ali and Burley 1998). Yet the kind of deduction that underlies analytic induction is flexible. Theory-guided research uses theoretical frameworks as a guide to focus a study. Researchers typically seek to modify the theory in the course of data collection and analysis (Gilgun 2015). Secondly, because of the nature of the study, the data was analysed by a single researcher and then discussed with the supervisor. Although this process promotes consistency, it fails to provide multiple perspectives from people with differing expertise.

This research was influenced by the belief that there is a better way to approach the assessment of GM crops in South Africa. This subjective viewpoint was outlined in the participant information sheet and informed consent that was sent out to potential participants. This way of interviewing thus rejects the position of 'the objective researcher'. The choice to conduct the interviews in this way may have had an influence on the difficulties that were experienced in gaining willing interview participants, due to

the controversial nature of the GMO debate. It was evident when interviewing a few of the participants that they did not share the views that were outlined in the information sheet, this sometimes affected the ease in which particular questions were raised.

Practical setbacks arose during the research process. Successfully gaining contact with relevant people proved difficult. Representatives of the government were particularly difficult to get hold of both by e-mail and telephone. In addition to this, there were many people who stated explicitly that they did not want to partake in the research due to the controversial nature of the topic. Further to this, due to issues of confidentiality that are outlined in the GMO Act, the names of scientists that serve on the Advisory Committee (AC) are not available to the public which made it difficult to contact them and ask for an interview. The AC is an integral and influential group in terms of GM crop risk assessment; this therefore leaves the research without their perspective. However, to try and overcome this limitation, a scientist who has previously served on the AC was interviewed. Another limitation of the research was the large number of people involved at different levels, all playing various roles in the assessment process. This paired with time and scope restraints made it logistically impossible to interview everyone involved.

3. 6 TAKING THE RESEARCH FORWARD

The pragmatist research paradigm may be in alignment with a feminist and post-structural paradigm, yet researchers from a more transformative – emancipatory framework have suggested that pragmatic researchers sometimes fail to provide a satisfactory answer to the question - for whom is a pragmatic solution useful? (Mertens 2003). This serves as a limitation of the pragmatic paradigm but also provides a means to overcome such a limitation. In context, this prompts the question, who will benefit from this research? In order to overcome this limitation, findings and recommendations emerging from this research will be presented to a range of South African policy-makers, including the key regulators of GM crops, with the aim of making the GM crop assessment process more inclusive, more accessible and ultimately more democratic. A policy brief, using the results of this research is also planned, accompanied by a journal article that will give a summary of the research. The next section will present the positionality of the researcher and outline the effects on the outcomes of the research.

3. 7 CONCLUSION

This chapter has sought to demonstrate how the research was carried out, as well as illuminate the theoretical and philosophical thread that has informed every stage of the research - from the research design, through to the data analysis and discussion. It began by stating the objectives of the research, followed by an overview of pragmatism. A pragmatic paradigm was used due the importance placed on selecting the appropriate methods that can best achieve the research aims and objectives. It also shares many theoretical values with feminist research methodologies, which, due to the nature of this research builds on the project's theoretical strength.

The positionality of the researcher was then explored in-depth. Feminist pragmatism provides an alternative to neo-positivist approaches and therefore seeks to acknowledge the subjectivity and unique perspective of both the researcher and the research-ed. Therefore, claiming and acknowledging positionality is vital to maintain robust research. This was followed by an outline of the methods that were used and the type of data analysis that was undertaken, before turning to the unique limitations of the research. The next chapter will present the findings that have developed from these methods, followed by an in-depth discussion of the results and some research reflections and implications.

CHAPTER FOUR

4.0 FINDINGS AND DATA ANALYSIS

The aim of this chapter is to present the findings that emerged from the data analysis. The general principles of a risk assessment, defined by the Cartagena Protocol on Biosafety (2000) will be given, followed by the common format of a risk assessment. This aims to give a clearer understanding of what GM crop developers are being asked for when they apply for GM crop permits. Following this, results of the investigation into the suitability of a feminist ethics of care framework will be outlined. The chapter will use the themes, derived from a feminist ethics of care and dominant moral theory (Table 2) as a way to punctuate and coherently present the findings and analysis.

4.1 THE RISK ASSESSMENT FRAMEWORK

The objective of risk assessment, under the Cartagena Protocol on Biosafety (of which South Africa is a signatory), is to identify and evaluate the potential adverse effects of living modified organisms (LMOs) on the conservation and sustainable use of biological diversity in the potential receiving environment, taking also into account risks to human health (CBD 2000). The outcome of a risk assessment is then used by authorities to make informed decisions regarding the release of LMOs. Figure 5 gives an overview of the general principles of risk assessment, followed by some key concerns. Figure 6 shows the common format for a risk assessment and adheres to Point (1) of the General Principles (Figure 5).

1. Risk assessment should be carried out in a **scientifically sound and transparent manner**, taking into account **recognised risk assessment techniques** and other available scientific evidence in order to identify and evaluate the **possible adverse affects** of LMOs on the conservation and sustainable use of biological diversity, also taking into account risks to human health.

2. **Lack of scientific knowledge** or scientific consensus should not necessarily be interpreted as indicating a particular level of risk, an absence of risk, or an acceptable risk.

3. Risks associated with LMOs should be considered in the **context of the risks posed by the non-modified recipients** or parental organisms in the likely potential receiving environment.

4. Risk assessment should be carried out on a **case-by-case** basis. The required information may vary in nature and level of detail from case to case, depending on the LMO concerned, its intended use and the likely potential receiving environment.

Figure 5, General Principles for Risk Assessments (CPB 2000)

1. Country taking decision
2. Contact details

LMO Information

3. Name and identity of LMO
4. Name of LMO Event
5. Introduced or modified traits
6. Techniques used for modification
7. Description of gene modification
8. Characteristics of modification

Recipient Organism

9. Name
10. How it was acquired
11. Characteristics related to biosafety
12. Origins
13. Habitats where it may proliferate

Donor Organism

14. Name
15. How it was acquired
16. Characteristics related to biosafety

Intended Use and Receiving Environment

17. Intended use of LMO
18. Information on receiving environment

Risk Assessment Summary

19. Detection method of LMO
20. Evaluation of the likelihood of adverse effects
21. Evaluation of the consequences
22. Overall risk
23. Recommendations
24. Actions to address uncertainty

Figure 6, **Common Format for Risk Assessment**
(In accordance with Annex III of the Cartagena Protocol on Biosafety)

In reference to point (1), the Protocol does not provide a definition of what constitutes a 'scientifically sound manner', nor what it considers 'recognised risk assessment techniques', nor does it explain the term 'possible adverse effects' and there are not internationally agreed upon definitions of these phrases. The lack of precise definitions has the potential to legitimise actions and decisions that may be used to further incumbent objectives. Point (1) also invites questions relating to what constitutes 'scientific evidence'. Mackenzie (2003) in 'An Explanatory Guide to the Cartagena Protocol on Biosafety' maintains that 'scientific evidence' to be considered should include; scientific data (statistical data, scientific theories, models) that will help to identify possible adverse affects. Evidence that might not be considered 'scientific' (indigenous, traditional, anecdotal knowledge) may also be considered where relevant, provided that "consideration is carried out in a scientifically sound and transparent manner" (p. 107, 108). The language of the 'General Principles' is precise enough to specify scientific information as the preferred form of evidence in the detection of 'potential adverse effects', which excludes other ways of conceiving of and presenting 'possible adverse effects'. Yet, the language is also sufficiently vague, leaving definitions and methodologies relating to scientific practice, to a large extent open to interpretation by the regulators.

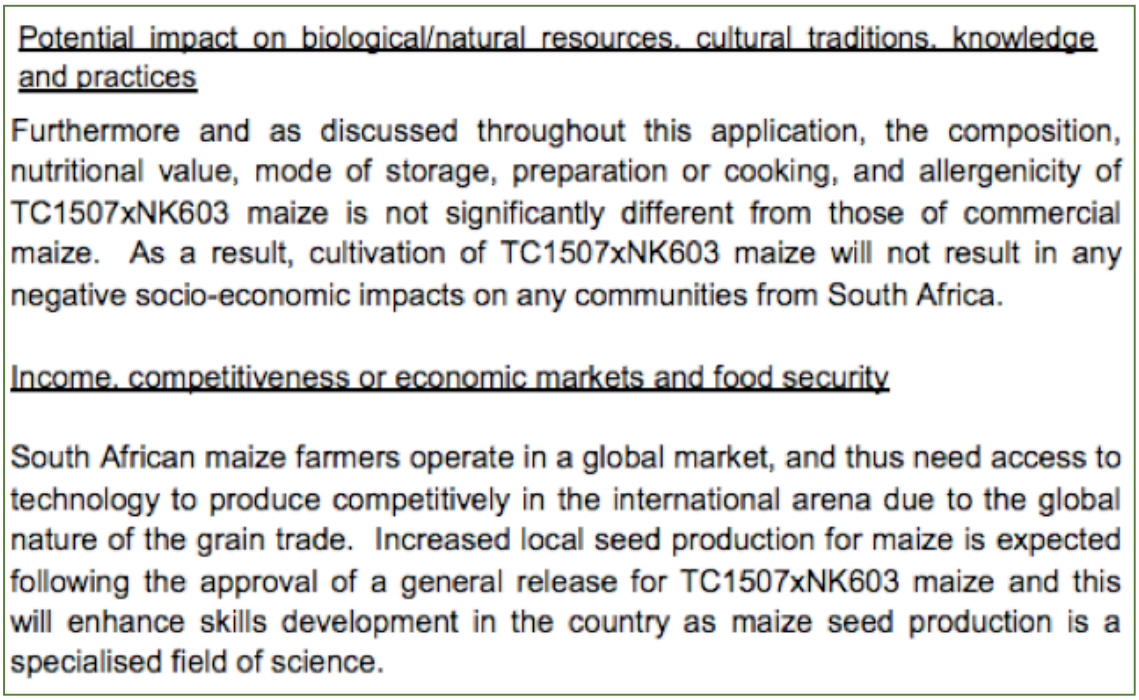
Point (2) is a reflection of the Precautionary Principle. Though Annex III (4) of the CPB (2000) recognises that "where there may be a lack of scientific knowledge or consensus on relevant issues, different countries may lawfully decide to make different choices in relation to the acceptability of any given level or type of risk" (Mackenzie 2003, p. 109). Again, this lack of precision can leave regulators unaccountable when unforeseen risks materialise and allows for a narrow framing of risk to persist throughout regulatory procedures. Point (3) is in reference to the PSE (principle of substantial equivalence), which provides a point of comparison for the risk assessment. This principle assumes that if the GMO can be shown to be chemically equivalent to its non-GM counterpart then the GMO under consideration will pose no new health risks and hence will be acceptable for commercial use. Figure 7 demonstrates the implementation of the PSE in a Monsanto application.

27. Evaluation of the consequences (Annex III.8(c)):	Studies conducted with MON 87460 × MON 89034 × MON 88017 confirmed that this event is agronomically and compositionally equivalent to conventional maize and has no increased tendency towards weediness or an increased susceptibility of tolerance to insects normally associated with maize. Thus, should any of the potential risks materialize, the consequences would be negligible.

Figure 7. Excerpt from Monsanto Application for Commodity Clearance MON 87460 x MON 89034 x MON 88017 (DAFF 2014)

This analysis focuses solely on the comparison between the GMO and its non-GM counterpart and fails to recognise significant differences present in various socio-economic contexts in South Africa. In addition, there is no recognised definition of what constitutes 'significantly different', and the application only states a few points of comparison that are considered – "composition, nutrition, mode of storage, preparation or cooking and allergenicity". The GM maize is thus not seen in context of the web of socio-ecological relations that sustain it and fails to acknowledge the fact that the process of producing GM maize is fundamentally different to that of conventional maize. Figure 8 also demonstrates the assumption, that 'maize farmers need technology to produce competitively in the international arena'. Further, even though the applicant is invited to comment on food security, this issue is not mentioned. This is concerning due to the acute state of food security in the country and the positive effect that biotechnology discourses in South Africa promise to have upon it.

Figure 8. Excerpt from a DuPont Application for General Release of Genetically Modified Organisms (GMOs) in South Africa TC1507xNK603 Maize (DAFF 2014)



Potential impact on biological/natural resources, cultural traditions, knowledge and practices

Furthermore and as discussed throughout this application, the composition, nutritional value, mode of storage, preparation or cooking, and allergenicity of TC1507xNK603 maize is not significantly different from those of commercial maize. As a result, cultivation of TC1507xNK603 maize will not result in any negative socio-economic impacts on any communities from South Africa.

Income, competitiveness or economic markets and food security

South African maize farmers operate in a global market, and thus need access to technology to produce competitively in the international arena due to the global nature of the grain trade. Increased local seed production for maize is expected following the approval of a general release for TC1507xNK603 maize and this will enhance skills development in the country as maize seed production is a specialised field of science.

What these figures show is not only the narrow definition of risk that is being considered, but also the narrow choice of methodologies that are considered valid for assessing such risks. The lack of precise definitions given by the Cartagena Protocol allows for wide interpretations on a number of important terms that can have serious implications for stakeholders. The varying socio-economic contexts present in the dualistic agricultural structure fail to be acknowledged which further demonstrates the narrow and scientifically dominated approach to risk assessment. The next section provides the results of the semi-structured interviews that explore the suitability of a feminist ethics of care as alternative framework with which to assess GM crops in South Africa.

4.2 QUANTITATIVE DEPENDENCE – RELATIONAL ONTOLOGY

Risk assessment was understood by the government and its representatives in similar ways and can be summed up as – *"the probability, the impact and the likelihood of a negative effect happening" (P10).* It was made clear by many of the participants that risk assessment lies at "*the core" (P1)* of GM crop assessment in South Africa and *"the most important thing is the role of scientific expertise. Our system is based on the scientific risk assessment which is done by competent people on whom we are*

absolutely dependent" (P10). The dependence on such scientific methods is a result of the purportedly flawless and monolithic status that science has been afforded in society; *"science is a methodology that has proven itself" (P10).* This ultimate faith in rational, experimental science is due its perceived objectivity and value-free framework of inquiry; *"as a scientist you are driven to make it non-personal ... this is why numbers become our lives - because they're not subjective" (P1).* In a society in which scientific knowledge has been afforded a monolithic status, a decision based on quantitative analysis appears to be fair and impersonal. Scientific objectivity thus provides an answer to a moral demand for impartiality and fairness. Quantification is well suited for communication that goes beyond the boundaries of locality and community, reducing the need for human relationships: a highly disciplined discourse helps to produce knowledge independent of the particular people who make it (Porter 1995, p. 8).

Biosafety South Africa noted that science is *"not an infallible system. But it's at least geared towards improving it" (P2).* This participant is suggesting that science is not the perfect system but the way to improve it is by producing further objective science. This suggestion still depends entirely on one way of knowing. A DAFF representative on the Executive Council of the GMO Act stated that there are *"a broad range of scientists on the AC, those involved in various elements of biotech, those with experience in plant biotech, those purely just biotech" (P3).* It will be noted here that a social scientist has never served on the AC. This raises questions concerning the true variability of knowledge that is involved in the assessment of GM crops and implies that experience in the biotechnology sector is viewed by DAFF as the most valuable and desirable type of experience. Further to this, the same participant proposed that reducing the departmental representation on the EC by *"only having DAFF staff" (P3)* would *"help in terms of doing the risk assessment" (P3)*. This assumes that involving fewer types of knowledge and perspectives is more efficient for governance.

These responses suggest that there is belief that various experts with varying knowledges are involved in the assessment process. However, the disciplines that are represented are still very much entrenched in 'the scientific method' that represents a single way of knowing about and conceiving of the world. This is accompanied by the thought that further reducing the number and the kinds of knowledge that are operating within the GM assessment system is one way of improving the infallible system of science.

In contrast to the statements from the Executive Council, rather than reducing input from other sources and perspectives and furthering scientific inquiry, a proposed solution from a former scientist at the Genøk Centre for Biosafety was instead to consider socio-economic, political and cultural aspects in the risk assessment in order to overcome the disagreement: *"you can't come to a final answer by only considering science" (P12).* Another perceived problem referred to the high levels of uncertainty present in the science on GM crops. A means to combat such uncertainty was to understand that knowledge is the result of many actors, and an appraisal process should *"recognise their perspectives and consider them." (P13)* The issue of uncertainty was also raised by a participant: *"there's always the possibility that there's something else that's unknown" (P11),* but again the way to overcome such uncertainty that was proposed by some, was *"to rely on the expertise of the scientists" (P10).* These statements offer two contrasting perceptions on ways to improve the GM crop assessment process. One suggests the need to further reduce the types of people involved in GM crop assessment and their associated knowledges, thus increasing the dependence on scientific expertise. The other deems it necessary to broaden the lens and increase the types of people and ways of knowing about GM crops and their associated risks. This broadening would address the relational ways in which different actors exist across the GM crop landscape and would open up considerations of other forms of risk that are often missed by an assessment system that depends so heavily on quantifiable forms of risk.

4.3 ISOLATION AND REDUCTION - PARTICULARITY AND CONTEXT

The risk assessment adherence to PSE removes the dimension of context, which ignores the method of production and the path by which food goes from producer to consumer, and denigrating aspects that cannot be quantitatively analysed to the realm of the arbitrary. This approach sees the GM crop under consideration in isolation of the food system in which it will enter. Some of the participants did not differentiate between the technology, which I will refer to as the isolated act of inserting the selected transgene into the conventional crop, and the technology in the context of society, as a web of socio-ecological relations. For example, regarding risk, one scientist at the Genøk Centre for Biosafety in Norway, stated that *"it's true, there are some risks that need to be taken but it's an over estimation. Once thresholds are set ... but then the same mono-crop is planted across millions of hectares of farmland, you magnify the risk. If you are going to compare the risk of planting a GM crop*

and compare it to an agricultural system, for me, the context has changed, the scale has changed and therefore the risk has changed as well" (P15).

By viewing the risk outside of the context in which it's likely to be found, a concerning reduction of complexity and scale is taking place that may be useful for risk management purposes but is not a true representation of the real and lived potential exposure to the identified risks. Biosafety South Africa took the position that *"those kinds of crops* [industrial crops: maize, soy, cotton] *could encourage industrial production, but when we look at risk assessment we can't compare the Bt*[18] *with an un-ploughed piece of veld, we must compare it to a commercial farm, but that's a technical thing" (P1).* This not only suggests a positive relationship between GM crops and an industrial agricultural system but it also demonstrates how a technical risk assessment approach cannot compare the risk of one scenario with another. This therefore makes it impossible to determine which scenario might be less risky within a risk assessment framework: essentially this approach necessitates a disregard of alternatives.

The acknowledgement that GM crops are part of and promote a bigger, more industrialised form of agricultural production was evident when speaking with the NGO ACB: *"GM based agriculture is the Green Revolution plus" (P17).* Their work therefore, is not restricted to GM crops and places emphasis on other parts of the system - seed laws and intellectual property. *"We want to work towards an ecologically sustainable food system ... part of that work is to critique and create opposition and resistance to green revolution farming systems" (P17).* They also extend this 'systems thinking' into the realm of regulation, seeing that *"the safety issue is part and parcel to a more equitable food regime" (P17).* Biosafety South Africa were explicitly critical of ACB for viewing GM technology as part of a socio-political, economic system saying; *"if you just say I don't like it because of Monsanto that's fine, but don't drag GM technology down because of the company that first commercialized it" (P1).* For proponents of GM technology, seeing the technology in isolation of its context is beneficial because it maintains a narrow focus for recognising risk. Widening the lens of risk opens up more potential risk pathways that would therefore require more risk management techniques that evidently have many political, economic and temporal ramifications. The cost of such

[18] In this case, the donor organism used in the process of genetic modification is bacterium - *Bacillus thuringiensis* (Bt). The gene of interest produces a protein that kills Lepidoptera larvae, in particular, European corn borer (Bessin 2004).

a narrow risk framework as a consequence of not seeing a GM crop as part of a broader system was also expressed by a researcher whose research interest lies in aquatic environments; *"I feel that aquatic ecosystems have been forgotten when it comes to GM crops. The initial risk assessments were performed in soil and terrestrial ecosystems and there was a basic assumption that the aquatic ecosystem would not be impacted. 'We're not putting them in water, so'... Have you ever known a farm to exist without water? You tell me" (P15).* By not considering the GM crop as part of an extensive and infinitely complex ecosystem with various levels of interaction, it is possible for entire parts of the ecosystem to be ignored and missed by a risk assessment.

One of the key founders of SAGENE expressed that, *"nature doesn't give us virus resistance, doesn't give us insect resistance, doesn't give us drought tolerance. So, we've taken the drought tolerance gene from a resurrection plant" (P18).* Here, genes are considered in isolation of the organism in which they are usually found, and further suggest that the contextual relationship of gene to organisms does not need to be considered. The proposed solution is the simple transfer of a single gene, which is looking at the problem from a 'zoomed in' microbial perspective. On the other hand, a representative from Biowatch, an NGO that promotes agro-ecological practices, perceived the problem of drought in a different way, stating that; *"GMOs are a symbol of industrial agriculture ... in terms of water use, industrial agriculture uses roughly 60% of that water for irrigation" (P22).* Here, GMOs are noted as part of and simultaneously promoting an industrial system of agriculture that is water intensive. The participant goes on to say that; *"agro-ecology uses water very carefully" (P22).* An agro-ecological perspective "*is like the bigger picture"* (P22) and sees GMOs as part of an intricate web of socio-ecological relations that has the capacity to solve problems by tuning into the different types of relationships that sustain the agricultural system.

To a limited extent the risk assessment of GM crops considers risks to the physical environment yet it does not consider this environment to be constituted of social-ecological relations. Rather, it sees the environment as a quantifiable arrangement of knowable interactions. This reduction of complexity is useful for risk management purposes but is not a true representation of the real and lived potential exposure to the identified risks. "While there is clearly a place for generalised statistical analyses of harm when assessing GM crops, the variability of social and ecological contexts means that such abstractions can also be misleading" (Preston and Wickson 2016, p. 51).

4.4 POWER - POWER AND VULNERABILITY

Risk assessment, because of its reliance on scientific information, is perceived to be a value neutral tool that is utilised to make impartial decisions about the risks of GM crops. As has been previously stated, this suggests that phenomena, which cannot be approached or examined by scientific methods, are not recognised as a field where knowledge can possibly be acquired and therefore are not interrogated (Kollek 1990). This complete dependence affords the institution of science the power to not only set the questions that will be answered but also choose amongst the most appropriate answers put forward. A risk assessment approach is heavily informed by expert language and dependent on quantitative information. These features implicitly empower some actors who possess the 'risk talk' and disempower others who don't: a feminist ethic of care approach recognises that defining risk is an exercise of power. The process by which some questions are made central and others are made peripheral or marginal is not simply a benign process of thought. Theorists' exclusions operate forcefully to set boundaries between those questions and concerns that are central and those that are peripheral. Biosafety South Africa affirmed this recognition, stating that during *"the process of risk assessment, you can only focus on particular things" (P1).*

This observation extends to the concept of cost/benefit analysis. Who states the costs? Who states the benefits? It is interesting to note here that many of the participants compared the risks and benefits associated with GM crops to those of driving a car; "*there are risks when driving a car and killing people, but we drive cars every day" (P18) "nothing is without risk, driving here this morning was a risk for all of us" (P3).* Here, when evaluating the risk of driving a car, the benefits are perceived as high and risks as low. However, much of the controversy within the GM crop debate pertains to the perception of high risk and low benefits. This relationship was noted by a food policy analyst in the UK, who stated that technological activities *"however profitable they might be, should only be permitted, if they provide benefits for consumers that outweigh possible risks" (P7).* So how can a risk assessment take this into account? One participant said, *"biosafety risk assessment doesn't really consider that ... you get a lot of experts together and state the possible harms" (P2).* And so not only is defining a risk an exercise of power but in defining the benefits, power is also exploited. A care ethic understanding implies that power imbalances are not entirely negative but rather emphasises the importance of recognising that those who are structurally marginalised, may possess specific insights that can help to critique the status quo. By acknowledging power dynamics,

marginalised voices may be re-cantered within the political discourse in order to strengthen counter narratives. The NGO Biowatch, for example, acknowledges the experience of farmers as fundamental for the work they do, providing insights that they don't have: *"there's something about recognising and hearing what small scale farmers say" (P22)* so not only do Biowatch want to help farmers but they see farmers as playing an active role in helping themselves.

Another way in which concepts of power emerged through the interviews, was the fear of corporate power; primarily, *"too much control of the food system" (P17)* was viewed by some participants as an effect of the adoption of GM crops. Other participants expressed that corporate power had already been exercised in the formulation of regulatory procedures for GM crops in the country, stating that the GMO Act is *"enabling legislation for big business for the multinationals" (P22).* Even though corporate power was cited a source of risk for many actors involved in the GM crop landscape in South Africa, a risk assessment approach reinforced by scientific expertise cannot account for this power imbalance and concentration of power. Power and politics are deemed to lie outside the scope of risk assessment and thus remain un-analysed and free to pervade the system. The large majority of permits that have been granted by the EC are to multinational companies, a dynamic that explicitly accrues power to the oligopoly of multinationals, leaving other actors in the system susceptible to their actions.

In addition to this, it was interesting to note that there was no consistency in answers relating to where power in the GM crop landscape is located and more specifically, which actors(s) possess the power to influence regulation and whose voices are heard the loudest. One participant noted that *"The GMO Act has complete power, nobody else has any power" (P18).* Another felt that *"the power is sitting with the corporates" (P17).* Other respondents cited that the *"power of discourse" (P6)* is worth noting whilst another mentioned the *"power of the system" (P11).* Further, the Chair of the Executive Council delegated power to the Minister of Agriculture. Therefore, it's clear that power, in this context, is indeed illusive, making it difficult to assess and consider in the regulatory process.

4.5 SINGULARITY - NARRATIVE AND VOICE

As has been demonstrated, within a science-based risk assessment approach, scientific knowledge is the only form of knowledge that is seen as being valuable to the risk assessment, whilst other forms are either not considered at all or are considered in risk analysis procedures. Feminist scholarship broadens the scope of risk assessment to include multiple actors who possess multiple knowledges. For too long, one version of the story of humanity has been told, which is characterised by the monolithic, patriarchal, Eurocentric story of science and modernity. Feminist theories seek to equalise the knowledge hierarchy, so that marginalised voices may be heard and listened to. In South Africa, the voices of 'experts' and beneficiaries of the system are seemingly accorded more value than those who do not engage in economic productivity. They therefore are unlikely to partake in, or influence decision-making, which renders them *passive* recipients of a risk assessment rather than *active* stakeholders. Feminist ethics of care, through an emphasis on narrative, can open the door to these power considerations by providing room for the voice of those who might ordinarily be excluded (Preston and Wickson 2016).

Multiplicity of Voices

The idea of multiplicity was common amongst participants who noted flaws in the current GM crop appraisal process. It was proposed in many ways as an alternative to singular, narrow definitions, understandings and conceptions of nature and of people. A multiplicity of voices was expressed as integral to a more democratic and socially just system of GM crop appraisal. A scientist at Genøk (P14) in Norway was concerned about *"being open"* and *"listening"* to *"minority views"*. This was cited as a way to minimise uncertainty. This stems from a specific understanding of the way in which knowledge is constituted. This was an understanding shared by the NGO ACB, who similarly expressed the need for the inclusion of other voices; *"this is what we know, other people know other things" (P17).* Further to this, one participant expressed that "*science is not a one-track race; it's an evolutionary branching process" (P8)*. This again is linked with how one perceives the structure of scientific knowledge; it was suggested that *"processes that open up appreciations for alternatives, perspectives and uncertainties (P8)"* are a way to be more scientifically rigorous - *"to say that there's only one way is anti-science" (P8)*.

In addition to the multiplicity of actors that should be involved in the appraisal process, the importance of *"organizing a polarity of scientific voices" (P7)* was also noted. As has been explored, ways of knowing shape and influence ways of seeing which makes it important to acknowledge a multiplicity of knowledges in order to maximize the perspectives involved to solve problems and make decisions in a more inclusive manner. In contrast to this, one of the founders of SAGENE recalled how they *"lobbied massively not to have politicians involved" (P18)* in the regulatory procedures. This suggests that a monoculture of knowledge (de Sousa Santos 2007, Shiva 1993) is desirable for those who seek to further the development and implementation of GM crops, because drawing upon only one type of knowledge makes decision-making more efficient.

Having *"empathy for those without a voice" (P19)* was also noted by one of the participants as motivation for their specific research, which involved the detection of DDT[19] in breast milk and bird eggs. This introduces the notion of speaking and silencing: who speaks when? And for whom? *"The silence of people that don't know what's happening" (P19)* demonstrates how silence gives rise to the voiceless: if one isn't aware, how can one make informed personal decisions? This is a salient issue in the GM debate when it comes to labelling. South Africa introduced compulsory GM food labelling in 2004, implemented by the Department of Health (DOH) under the 'Foodstuffs, Cosmetics and Disinfectants Act of 1972 – Regulation 25. In addition to the more recent 'Consumer Protection Act of 2008 - Regulation 293 from the Department of Trade and Industry (DTI) that states all GM goods must be labelled. So, where Regulation 25 is based on health and food safety concerns, Regulation 293 is purely value-based, hinging on the consumer's intrinsic right to information. However, when between 70 and 80 per cent of the country's staple crop (maize) is genetically modified, consumer power is dramatically reduced. This, in addition to socio-historical marginalisation has resulted in a huge section of society with no means to raise their voice, and no freedom to choose, which leaves them *"silently screaming" (P19).*

In its day-to-day work, Biowatch seeks to provide a communication platform through which farmers can communicate their concerns to the government. Situating themselves between the government and small-scale farmers, they hold a unique and influential position that they ensure is not exploitative. They ensure this by being careful *"not to speak for others if others can speak better or*

[19] Dichlordiphenyltrichloroethane is a colourless, tasteless, and almost odourless crystalline organochlorine known for its insecticidal properties and environmental impacts (NIOSH 2016)

instead of us" (P22). This respect for another's voice was evident in other interviews (P15, P17, P19) yet it was also noted *"even if the voices are heard, there isn't evidence of it translating into legislation" (P12).* This means that hearing a multiplicity of voices is only the first step; listening to voices must be followed by action. A feminist ethics of care approach calls not only for the identification of need but also for that to be manifested into action. 'Caring about' something without action is not care (Tronto 2003). Thus, 'taking care of' is cited as the action that must precede 'caring about' which requires that responsibility be taken for the need that has been identified.

The importance of communication between the multiplicity of actors to allow for the emergence of democratic objectives was also encouraged by many of the participants; *"too much silo discussions are going on: we have our discussions, government has their discussion and industry has theirs" (P17).* This communication, complemented by the need for a *"common language" (P2)* amongst the actors involved was cited as a way in which everyone can begin to *"live on a common landscape" (P17). "Broadening the scope of risk assessment" (P11)* was cited as a means to allow for a multiplicity of actors and their voices to be heard and listened to, thus allowing for previously silenced issues to be raised and acknowledged.

An Economic Narrative

Narrative, as a care ethics theme, was interpreted somewhat differently in the context of this research. Rather than looking at how narrative - as story-telling can illuminate different voices and re-centre marginalised perspectives, this interpretation looks at how dominant narratives influence and shape the appraisal process of GM crops in South Africa. Principally, the narrative of economic growth was particularly strong amongst participants from governmental departments. 'Operation Phakisa'[20] (2016) was cited by a representative of the Department of Science and Technology (DST) as an important document that, *"calls for heightened consideration of more inclusive models of growth",* in the face of "*rising inequality"* and focuses *"quite strongly on small-scale and subsistence farming"*

[20] Operation Phakisa is a fast results delivery programme launched by the South African government in July 2014 to help implement the National Development Plan (NDP), with the ultimate goal of boosting economic growth and creating jobs (Department of Planning, Monitoring and Evaluation, 2014).

(Department of Agriculture, Land Reform and Rural Development 2016). The Operation Phakisa Concept Document (Department of Agriculture, Land Reform and Rural Development 2016, p. 14) states; *"rapid and sustained poverty reduction requires inclusive growth that allows people to contribute to and benefit from economic growth. Without addressing inclusion, social and economic, the very nature and essence of our growth processes becomes questionable. It is thus the primary objective of Operation Phakisa of Agriculture, Land Reform and Rural Development, to ensure the formulation of required interventions towards greater economic inclusion."* The DST representative goes on to say that *"any agricultural technology that can help that* [Operation Phakisa] *is obviously relevant" (P10).* This is also supported by the document itself, noting that one of its key objectives is *"to determine the role and relative importance of technology development and innovation to advance agricultural production and sustainable livelihoods"* (Department of Agriculture, Land Reform and Rural Development 2016, p. 15).

Further to this, Biosafety South Africa also addressed the implicit ethical aspect of offering GM technology to farmers who use more traditional methods. They expressed that, if the technology is available and it has the potential to contribute towards food security then they *"have the responsibility, in terms of government"* to offer it. They also articulated an alternative scenario in which they don't offer the technology, and voiced that *"at least they can keep their pathetic seeds" (P1).* These statements not only naturalise the discourse that having access to GM seeds will somehow pull poor farmers out of poverty and maintain food security but it also acts as a linguistic indication of a particular 'way of seeing' indigenous agricultural practices such as seed saving. Further to this, a DST official stated that; *"we want these people to actually get an active economic livelihood out of the process ... saving seed is going to be suboptimal to the hybrid seeds, it's not going to help them become commercially competitive" (P10).*

The government preference for commercial agriculture was also evident in the 2015/16 to 2019/20 Strategic Plan, published by DAFF in 2015 (p. 27), which reads that the NGP (National Growth Plan) and the NDP (National Development Plan) will provide for "*the expansion of irrigated agricultural production, the conversion of under-utilised communal land into commercial production and support commercial agricultural subsectors with the highest growth potential and regional integration within the context of agriculture."* The DST representative expressed how they do not see small-holder agriculture as part of a food secure and economically successful South Africa; *"how can*

we expect our small farmers to compete? I'm not convinced that they [small-scale farmers] *will play a significant role" (P10).*

Building upon the earlier observation that commercial agriculture was viewed by many of the participants as the most desirable form of agriculture for the future of South Africa, this section will show how this notion simultaneously feeds and is fed by the growth narrative. Questions were raised about *"how we understand progress?" (P8).* Many participants felt that there was *"only one definition of progress" (P15)* being represented across the agricultural landscape and it was explicitly stated that *"economic growth is one of the strongest drivers".* The government confirmed this by saying that *"agriculture has been identified as one of those sectors that can drive job creation and economic growth and that's the only thing we have to focus on given our country's situation" (P10).* Backed up by various phrases like *"speed up" (P10), "create jobs" (P3)* and *"new wealth" (P4),* this demonstrates the strength of the growth narrative amongst government officials. There was also an explicit assumption that economic growth leads to food security - *"empirical evidence of the economic benefit which obviously relates to food security and social security dynamics" (P3).* This assumption relates to 'ways of seeing' the issue of hunger. One participant referred to *"institutional delineation" (P6)* in which the housing of food security in DAFF *"assume[*s*] it is an agricultural problem" (P6).* This assumption leads to agricultural-based solutions to the problem of hunger, solutions which therefore stem from the optimism of productivity.

The drive to *"bring farmers to market" (P1)* echoes this notion that having access to the market from which they were previously excluded is the best way to support livelihoods. Market access was intimately tied to the concept of productivity in which an increase in productivity was assumed to lead to better access to 'the market'. A representative from DST voiced that "*we can't have these small pockets of unproductive areas ... we want them to become commercial ... we want these people to get an active economic livelihood ... our ultimate goal is to have economically active people" (P10).* A Science and Technology Policy analyst from SPRU expressed that the concept of growth itself has been wrongly interpreted, comparing growth as a mechanistic idea in which *"parameters get bigger" (P8)* to an intuitive perception of growth as human beings *"which is qualitative, emergent* [and] *multidimensional" (P8).* Other participants shared this concern that the dominant and reductive interpretation of growth suppresses others' interpretations; *"success is only measured in tons and profit, but what about how much you saved? How well did you treat the system? How sustainable is*

it?" (P15). In the context of agriculture in South Africa, this provokes concerns not only about an increase in yield but also about what kind of yield, of crops, of food are we talking about? Is it nutritious? Is it tasty? These questions are completely ignored by a risk assessment approach because a risk assessment is perceived to operate in an 'objective sphere' and its social, political and cultural implications are not prioritised.

An effect of the strong neoliberal growth narrative and the language it employs places emphasis on economic activity. This preoccupation with economic progress erodes our human-ness and we begin to imagine ourselves only as economic subjects, where our value as humans is equated only by our economic activity rather than by our social and cultural activity. This notion was well articulated by a participant who specialises in local economic development and food security in South Africa who expressed that neoliberal narratives force us to *"see ourselves primarily as consumers and primarily as individuals" (P6).* In another interview, an agricultural economist from South Africa voiced, *"if you are an African and are dirt poor, you are not going to worry about the GM crop, you just want to produce anything to eat" (P21).* Linguistically, this is a very reductionist perspective of an entire continent's attitude towards food, feeding and eating: not only that, it also suggests that one's level of income determines one's preference to food. If we draw upon concepts of 'food as culture' (Pretty 2002, Jarsoz 2000) and 'food as process' (Bizzarri 2012) then this statement also suggests that level of income undermines traditional agricultural practices, indigenous knowledges and cultural ties. In contrast, however, another participant noted that farmers and consumers are not *only* driven by economic concerns but take into consideration the "*goodness*", "*safety*" and "*naturalness*" (P14) of food. Another example of the way in which the growth narrative has surpassed all other contexts is the way in which Biosafety South Africa continually referred to GM crops as *"products" (P1, P2).* This is an explicit statement that demonstrates how GM crops are perceived by the institution not as crops, not as food but as an economic commodity.

There was no denying the fact that commercial interest and economic growth are at the source of GM crop innovation in South Africa; *"soy, cotton and maize were developed because they are the big international crops; it was businesses that developed them and they have a financial interest" (P1).* The cost of research was cited as the main reason why the commercial interest in GM crops is so great. A microbiologist at the University of Cape Town felt that the reason for this is due to regulatory hurdles, hurdles which they see as a result of fear radiated from the *"anti-GM lobby" (P18),* which makes scientists like them *"dependent on multinationals" (P18)* for funding. A scientist

from Norway expressed that *"innovation and technology are driven by the growth ideology – the more you produce the better ... the ones who argue strongly that growth is the future will try and minimise the risks" (P13).* This interrogates the relationship between risk assessment and economics, how the established, narrow, quantitative and expert-based analytic procedures of risk assessment tend to privilege economic considerations and incumbent interests (Collingridge 1980, Schwartz and Thompson 1990, Flyvbjerg 1998). This relationship was also acknowledged to be present in the GMO Act (DAFF, 1997 [2006]), with some participants referring to it as *"enabling legislation" (P17, P22)*, indicating that its *"vague wording" (P22)* can be and has been utilised by interest groups to further their agendas.

4.6 RATIONALITY - EMOTION

A feminist ethics of care approach to risk assessment acknowledges that scientific experts, like the public, make decisions that are influenced by emotion and affect and this is something to be recognised, not ignored or disregarded as an obstacle to perceived objectivity. Many of the participants perceived the public to be *"too emotional" and* "*uninformed"* to make acceptable risk decisions, that their concerns are "*unscientific*" and due to *"not having a technical background*", and that their perception of risk is *"not real"*. Experts are seen as providing risk assessments, characterised as objective, analytic, wise and rational - based on the "*real risks*" (P1), and the public are seen to rely on "*perceptions of risk*" (P2) that are subjective, often hypothetical, emotional, foolish and irrational. A food policy analyst in the UK called caution to this unfettering belief in the objectivity of science, stating that *"science is evidently an indispensable component of risk assessment but it is dangerous when it is misleading, when it's presented to be independent of all value and judgements."*

Studies have shown that factors such as gender (Steger and Witt 1989, Barke, Jenkins-Smith and Slovic1997), race (Flynn, Slovic and Mertz 1994), world view (Dake 1991), emotional affect and trust (Peters and Slovic 1996, Slovic, Flynn and Layman 1991) are strongly correlated with risk judgements. Equally important is that these factors influence the judgements of experts as well as the judgements of laypersons. Yet, many of the participants are still highly *"dependent on the scientific expertise of [*their*] advisors"*because of *"the value system of a scientist is to take subjectivity out of it."*

In another way, feeling *"uncomfortable"* was cited as a way that some people might feel towards the idea of genetic modification - *"people might have a knee jerk, gut-level reaction that something is wrong"*. However, in a science-based risk approach these feelings and instincts are not seen as contributing valid knowledge to the appraisal process. *A "funny feeling"* cannot be quantified and therefore cannot be analysed in a risk assessment framework. Similarly, another participant expressed frustration at how the GM debate sometimes sparks emotional and irrational responses, which are perceived to stifle biotechnology innovation: *"there's this amazing technology and then, for some other, non-scientific reasons it became a controversial thing"*. This statement not only illuminates the invalidity of emotion as a way of knowing but also buttresses the monolith of science as *the* only way of knowing.

A virologist at the Genøk Centre for Biosafety in Tromsø, passionately expressed his love for the structure and organisation of the scientific method and firmly believed in its objectivity and the neutrality of the scientists that carry out its methods: *"risk assessment is very contrary to emotion, it's about making a conclusion based on quantifiable data"*. Again, the absence of emotion is cited as the gift of science, and emotion is non-existent for proponents of the scientific method. The emphasis that a feminist ethics of care places on affect and emotion does not mean that reason is excluded from moral decision-making. The recognition that experts as well as the public are affected by emotion renders the feelings and emotional responses of people *other than* experts, valuable to a risk assessment. It also understands that uncertainty exists in both quantitative and qualitative forms. This perspective offers us the possibility that feminist care ethics and the current science-based risk approach to appraisal are not mutually exclusive. It suggests that rather these are frameworks that can benefit from working together. This more permeable approach may be more appropriate for overcoming practical agricultural governance issues than reductively choosing between one or the other. However, this would require more than just the incorporation of care ethics into the existing appraisal framework, but a need to re-imagine and re-design both approaches.

4.7 PUBLIC + PRIVATE - PUBLIC = PRIVATE

Using a science-based risk assessment framework for the appraisal of GM crops insists that only some form of risks - principally, risks to human and animal health, to the environment and to a lesser degree socio-economic - are necessary to consider. This narrow framework that limits the types of

risk that will be assessed also limits the extent to which responsibility can be justly allocated. For example, a Professor of Science Policy at SPRU who has been heavily involved in food safety policy in the UK since the 1970s, said that whilst working for DEFRA (Department for Environment, Food & Rural Affairs), he expressed the need for socio-economic evaluation in GM policy to which they responded; *"oh no, we must not use socio-economic criteria, we must leave that to the market".* Similarly, during the late 1980s in South Africa, faith in the free market had never been greater and the country was riding the wave of neoliberalism propelled from the UK and US. Through extensive deregulation, the economic sphere was left with its own logic of operation and an unprecedented freedom to cut itself loose from the complex web of social institutions (Polanyi 1944), which were essentially the collective guardian of ethical standards (Bauman 2002, p. 77). It must be noted that socio-economic issues are considered in the GM crop assessment for GMO release in South Africa (DAFF 2010), yet these concerns are not part of the formal risk assessment but are considered during the wider process of risk analysis.[21] The demarcation that is evident between science and society is due to the assumed objectivity and value-free nature of rational scientific inquiry, which is in contrast to the value-laden, emotional and subjective 'messiness' of matters in the social sphere.

The neoliberal narrative of 'leaving it to the market' is evident in what a risk assessment includes and excludes. This demarcation of social responsibility to the market is also reflected in the South African government's approach to risk assessment; *"ultimately the risk assessment is there to protect the end user but if you look at risk management measures it's also to protect the developer ... if the user messes it up, if the user was supposed to have taken these steps and it was not followed even after being instructed you can't really blame the technology developer" (P3).* This is a prime example of the rationality of a liberal government that stresses the need to respect the freedom of economic processes, through deliberate self-limiting: what Foucault (2008) termed 'not governing too much'. Neoliberalism rather encourages the idea of active citizenship, whereby people, rather than the state, take responsibility for their own social and economic well-being.

Another result of neoliberal deregulation is that socio-economic considerations have not been prioritised. Biosafety South Africa remarked *"socio-economics was like the third person that came to the party ... it was a market thing ... it only became an issue when the Cartagena Protocol said we*

[21] Figure 3 demonstrates how Risk Analysis is comprised of a scientific-based Risk Assessment, Risk Management practices that are implemented through government policies and processes of Risk Communication. Signing the Cartagena Protocol on Biosafety gives South Africa the option to consider socio-economic issues, which would be part of Risk Management.

must consider this" (P1). The Cartagena Protocol on Biosafety (2000), ratified by South Africa in 2003, suggests a significant departure from the dominant assumption that science-based risk assessment is the only justifiable method for evaluating the impacts of biotechnology due to its insistence on the application of the Precautionary Principle. It can also be interpreted, using Polanyi's concept of 'the double movement' (1944) as part of a countermovement to the normative hegemony of market expansion. This countermovement involved efforts to re-embed markets within social institutions in order to protect societies from the adverse social and environmental consequences of the free market (Carroll 2016, p. 4). Further building upon Polanyi's concept of 'the double movement' (1944), NGOs involved in the countermovement in South Africa seem to be filling the neoliberal void of social responsibility, articulating that they should play *"a watchdog role. We [ACB] believe it's really important to continually keep our government accountable and keep corporates accountable".* Biowatch responded in a similar way; *"our role is to hold them accountable, to help other NGOs and civil society deconstruct, unpack and reveal" (P17).*

Another way in which the concept of the public-private split emerged from the interviews was how the participants spoke about the relationships on which they depend for their work. There were only three that spoke about personal relationships (friends and family) and the positive effect that they had on their professional lives. An eco-toxicologist from South Africa answered humorously; *"I am married",* and then proceeded to talk about his professional relationships. However, throughout the interview he often mentioned his wife, which made it apparent that she influences and sustains his professional experience as an eco-toxicologist to a fair extent. The humorous nature of his response indicates that he maybe feels that he shouldn't have mentioned her, or that the academic nature of the research wouldn't be interested in that part of his life. A feminist ethics of care seeks to reconceptualise the boundaries between public and private and acknowledge their inevitable interconnections. Further to this, another eco-toxicologist from South Africa explained how she has *"a husband and a baby"* and they are her *"saving grace"* when she gets home after a hard day's work. Later she mentioned how *"especially"* after having her baby, she feels that she is no longer considered a scientist but - *"a woman doing science"* and that her *"real job is to have a child"*. The demarcation of the public and the private spheres of activity is apparent in this statement, and can suggest how the institution of science and its Eurocentric, masculine methodologies further entrench the reproductive imperative of women, and diminish their role as active participants in the public sphere.

Examining how the theme of 'public-private', as outlined in feminist literature, surfaced during the interviews, begins to unravel the tightly wound conceptual thread that keeps this boundary in place and intimates how it might be beneficial to reconceptualise this split in the context of GM crops in South Africa. This recognition seeks to blur the lines between public and private, important/unimportant, acknowledged/unacknowledged, the market and the government, quantitative/qualitative and hard and soft issues. In doing this, the lens of risk assessment may be broadened to include concerns that have traditionally been deemed irrelevant to the public domain. Through a feminist ethics of care lens, the responsibilities towards humans and the environment are not 'left to the market' but are integral to re-imagining the subject not as economic but as constituted of their socio-ecological relations. At the same time, a feminist ethics of care aims to re-centre the experience of women, in which studying the oppression and dispossession of women and other marginalised groups is not an after-thought, but integral in understanding the processes of patriarchal capitalist accumulation within the realm of agriculture, food and farming. Using the findings from the data collection and analysis, the following section provides some brief policy recommendations.

CHAPTER FIVE

5.0 DISCUSSION AND REFLECTIONS

Studying how appropriate a feminist ethics of care approach might be in the context of GM crops in South Africa required mixed data analysis methods. This has allowed the research to remain reflexive and let other results and other ways of seeing the data emerge. The following chapter will bring to light themes and reflections that developed from the interviews that have not been acknowledged by a feminist ethic of care framework. This invites some reflections and policy recommendations for a more suitable framework for the assessment of GM crops in South Africa.

5.1 WAYS OF SEEING

The way in which one sees the world is a result of an infinitely complex story of decisions and revisions that take place throughout an individual's life. It surfaced during the interviews that the participants' 'way of seeing' the world, had an influence on the way they perceive the risks and benefits of GM crops and thus, how they interpret the regulatory processes. A fuller understanding of the problems with the appraisal process of GM crops may be realised if the ontology of the participants is acknowledged and explored. For participants that had tertiary education, it was clear that the academic discipline that they had studied, heavily influenced their 'way of seeing' the world. Disciplinary knowledge "designates a domain of knowledge with a certain degree of specialisation and definite forms of control over the production and diffusion of knowledge" (Heilbron 2004, p. 26). Conventionally, disciplines have primarily been associated with specific skills and specialised knowledge and have originated in the natural sciences (Heilbron 2004). Disciplines draw upon specific knowledge and ways of knowing that guide how an individual may navigate themselves through the world. For example, an agricultural economist stated that he draws upon *"economic-based* [knowledge] - *profitability I think" (P21).* The lens he utilizes for his research is one that magnifies the economy and profitability. A DAFF representative on the Executive Council is *"trained as a microbiologist and part of that relates to biotech so* [he has] *experience in biotech" (P3).* Another participant, who was one of the founders of SAGENE was *"a straight microbiologist ... and then got into industrial microbiology" (P18).* By spending time studying one discipline, you are simultaneously *not* studying other areas of knowledge and this shapes the way an individual sees the

world and ultimately - the way that a problem is perceived affects the solutions that may be put forward.

Another participant demonstrated how possessing one type of knowledge, or having 'expertise' in one particular area, means that you don't possess other ways of knowing or other expertise. This could result in miscommunication when collaborating with other people who know differently: *"some people would be chemists and some - biologists, and they don't have an understanding of both fields, only their own field" (P20).* The same participant went on to say how she feels she has benefited from studying in a more interdisciplinary manner; "*I think eco-toxicologists can really understand what's going on in the environment if you are willing to do both, to understand both" (P20).* A senior researcher at the Science and Policy Research Unit (UK), an institute that prides itself on an interdisciplinary approach to academia stated, *"it's difficult to fit into academia ... I like an interdisciplinary approach politically as well, because I think disciplines are political and I hate dogma and that's what disciplines are" (P8).*

Some of the participants also seemed to question the assumed categories that they had been assigned to during their academic lives; *"I wanted to do my Masters on small-farmer access to markets ... I ended up doing a Masters degree in agricultural economics by default, that's how Stellenbosch just sort of allocated me ... for my PhD I wanted to do an ethnography ... to explore theoretical framings of the problem which just weren't possible in economics, so that's how I ended up in Anthropology" (P6).* This quote explicitly shows the limitations of rigid disciplinary study. By establishing an acceptable way of doing, knowing, seeing from one perspective: simultaneously, the unacceptable is also established. This binary creates a normative framework through which one can appropriately analyse the world. One participant expressed this idea very succinctly: *"by having a framework, you are making a very efficient way to lock out other concerns – it's not in our framework so why should we look into this?" (P13).* In terms of the risk assessment, *"there are people hired to do an assessment like this, they have the training within this frame" (P9).* It was evident that rigidity was a problem associated with the way risk assessment is done and a barrier to other ways of seeing risk.

Building upon this notion of 'framing', it was recognised that, in terms of regulation, the government department in which an individual and their responsibilities is placed also influences the theoretical framing of the problem: *"obviously there are some departments, whose mandate it is to push for*

development of a specific scientific discipline" (P1). The Department of Science and Technology (DST) is the most significant funder of Biosafety South Africa, a government body that "*sits between the regulators and the developers ... go through applications, interpret and translate for* [the developers] *... in order to manage risk" (P1).* Their mandate is "*to support the sustainable development of biotech products, of which GM is one" (P2).* Here, the position of DST is explicit – *"to support"*. This affirmative language is not neutral. In terms of biosafety risk management, there is a clear predisposition towards the benefits of GM technology in order to *"develop the biotechnology sector" (P2).* Another representative from DST explained *"we are looking for positive impacts to our economy and industry" (P10).* Genetically modified crops are proposed as the solution to the issue of food security which, together with its legislation, is housed in DAFF, implying that "*when you make an institutional decision about where something is located it's based on an implicit assumption about what the problem is" (P6)*. This very act assumes that food security is an agricultural problem and the officials in DAFF only have one lens through which to view the problem that makes it impossible to look at other things that may be contributing to the same problem.

A representative of ACB articulated how a communication problem exists between different stakeholders involved with GM crops in South Africa, that they cannot see eye to eye because their ways of seeing differ very dramatically: *"Monsanto is on another landscape. Our government is on the Monsanto landscape and the scientists have their science. They have their truth and we have our truth" (P17).* A scientist from the Swiss Federal Institute of Technology who has extensive experience on scientific advisory committees in the EU states that *"you get away with the idea that a biotechnology person is the best person to assess biotechnology and that's why these committees are full of biotech people ... but they're not looking for risks ... you should stash your safety committee with experts in the fields that you want to look for fallouts" (P9).* This suggests that the particular type of professional training that an individual receives shapes expertise, and this expertise, in turn provides the lens through which one conceives of the world. In the context of GM crop regulation, the individuals who sit on the various committees have specific 'ways of seeing' GM crops, which include their risks and benefits. These ways of seeing, in turn, percolate into regulatory decisions that are made. For example, government officials from the Department of Science and Technology, referred to GM crops as constituting part of *"the basket of technology" (P1, P2, P3, P4, P10) that* should be available to all farmers. This is a symptom of a fervent technological optimism that plays a significant role in which type of agriculture the government promotes and thus influences the

trajectory along which all agricultural development will follow. Perlas (1995) demonstrates how technocrats will propose technological solutions to complex social problems. This suggests that 'ways of seeing' must be taken into consideration in a risk appraisal and further suggests that including a variety of people with different ways of seeing and knowing, will buttress regulatory procedures, making assessment more holistic and democratic.

Not only do academic disciplines influence the way that students of those disciplines see the world, but one's positionality also impacts 'ways of seeing'. Slovic (1999) and colleagues have studied extensively the way in which positionality influences perceptions of risk. "Danger is real, but risk is socially constructed" (Slovic 1999, p. 689) which makes risk assessment inherently subjective. Studies have shown that aspects such as gender, race, political views, emotional affect and trust are strongly associated with risk judgements. For example, Slovic *et al* (1997) found that female members of the British Toxicological Society were far more likely than their male counterparts to judge societal risks as moderate or high rather than low. Even more interestingly, a study conducted by Flynn, Slovic and Mertz (1994, p. 693) looking at gender, race and risk perception found that white males perceived risks as much lower than the other three groups (white females, non-white females, non-white males). They go on to think about why white males might see the world as much less risky than others see it and come to a pertinent conclusion "perhaps white males see less risk in the world because they create, manage, control, and benefit from many of the major technologies and activities" (Slovic 1999, p. 693). Women and non-white men, in contrast, might perceive more danger in the world because they are more vulnerable and might not advantage from technological developments and institutions in the same way as white males because due to structural racism, they hold less power and have less control over what happens in their communities and their lives.

These studies demonstrate the subjective and contextual nature of risk and point to the need for new approaches towards risk assessment and analysis. Stirling (2005) discusses how the social appraisal of technology has the potential to play a role in either 'opening up' or 'closing down' wider policy discourses on science and technology choice. Stirling (2007, p. 278) sees a risk assessment approach as including "narrow, rigid, quantitative, opaque, exclusive, expert-based, analytically, rigorous procedures, which tend to privilege economic considerations and incumbent political and commercial interests." This approach to the assessment of risk ignores the messy, the complex and the conflicting interests and perspectives. In doing this, ease and efficiency are prioritised in order to develop clear and authoritative recommendations that will inform decisions. In contrast, if appraisal

aims to 'open up' a process of technological choice, then the focus is somewhat different. Here, the emphasis is placed on revealing any intrinsic uncertainties, contingencies, or capacities for agency to wider policy discourses. The aim then, is to explore the degree to which results acquired during the appraisal processes are sensitive to different framing conditions and assumptions. "Instead of focusing on expert informed and prescriptive recommendations, the appraisal could pose alternative questions which focus on neglected issues, include marginalised perspectives, consider opposing knowledges, test sensitivities to different methods, study overlooked uncertainties, examine different possibilities, and highlight new options" (Stirling 2008, p. 300).

5.2 IMAGINATION

There were two opposing concepts of imagination that emerged from the interviews. One echoes the *"Enlightenment imagination" (P8)* that aims to stretch the limits of science and to control nature on the genetic scale. This image has its roots in the Scientific Revolution with links to the *"deep master narrative" (P8)* in which nature was imagined as a machine where parts can be removed and substituted; one atom can be changed for another; one organism can be introduced and another taken away. "Nature essentially becomes an instrument and the human mind itself an instrument operating on nature" (Merchant 2008, p. 736). This enlightenment imagination was evident in those who favoured GM crops; *"we can take it* [drought tolerance trait] *from a resurrection plant and insert it into the crop" (P18).* This control exerted upon nature at the genetic level is a product of a way of seeing nature – as *"mechanical"* with *"no plasticity", "no diversity", "no variability" (P9)*. However, another way of seeing nature refutes this way of seeing by demonstrating *"that's not how it* [nature] *works" (P9).* In addition, one participant linked the notion of control to the Calvinist religious philosophy, which is particularly common amongst the white Afrikaner population[22]: *"man was given control over God's creation which allows him to do what he wants" (P19).* A senior researcher at Zurich's Institute of Integrative Biology (P9) in Switzerland expressed her concerns for the future of genetic modification and the rapid pace at which biotechnology is developing. She referred to GM crops as *"old technology"* and expressed that synthetic biology[23] or *"GMOs 2.0",* is *"pure fantasy"*, which echoes the enlightenment, scientific imagination and is embraced by many of the

[22] Afrikaners are a Southern African ethnic group descended from predominantly Dutch settlers first arriving in the 17th and 18th centuries (Garvin 1933)

[23] Synthetic Biology is an emerging discipline that uses engineering principles to design and assemble biological components (Oye and Wellhausen 2007)

biotechnology companies and their marketing strategies[24]. Further to this, with extensive experience in the risk assessment of GMOs and as someone who is not convinced of the imagined promises of biotechnology, she also stated how she would not *"do* a *fantasy risk assessment for a fantasy product"*.

The other imagination paints a picture of possibility, in which the potential for a more inclusive and socially just food system may be realised. This is achieved by *"asking different questions" (P13)* in order to illuminate alternatives. One participant noted, *"to introduce a notion of alternatives is the single most radical thing you can do" (P9)*. This is because progress and development are portrayed in a successive, linear, monotonic way, which affords room for only one paradigm - one way of thinking, seeing and doing. Therefore, going against this grain is radical in itself because the narrative of Modernity is so deeply entrenched. Instead, with an imagination of possibility, progress may be understood in terms of emergences, of *"contending paths" (P9)*. Pathways to social and environmental justice were common goals amongst participants who were engaged in the promotion of alternative types of agriculture. Biowatch for example, seeks to promote agro-ecology as a *"viable alternative to the industrial agricultural system" (P22),* of which GM crops are a part of and promote. ACB spoke about how, at a time the biosafety of GM crops was the centre of their work, but now, more recently they are focusing on *"seed laws and seed sovereignty" (P17).* This shift indicates reflexivity, and awareness that there are multiple ways to realise alternatives.

However, a lack of imagination of alternatives was also present amongst some of the participants: "*Is there an alternative [to science-based risk assessment]?" (P3), "I can't think of an alternative ... it's relatively objective and absolutely evidence based, and so is meant to be convincing and I certainly subscribe to that" (P10), "I think the risk assessment is the best way to go about it" (P1), "I'm not aware of an alternative approach" (P23).* Not only is a lack of awareness *of* alternatives evident here, but so to is a lack of motivation to *look for* alternative approaches. The regulation of biotechnology in Norway provides a good example of an alternative approach to risk assessment; they not only stipulate that a GM crop must be substantially equivalent to its non-GM counterpart, they request that it contributes to sustainable development and will be a benefit to society (DIRNAT 2011). One participant summed up the approach with this analogy: *"There is risk in crossing the road, but Norway is saying; show me a better way to cross the road and we will do it" (P15).*

[24] Way in which concepts of the future science is used by marketing in biotech companies

A science-based approach to the risk assessment of GM crops automatically locks out potential alternatives to the perceived problems that GM crops are said to solve. At no point during the appraisal process is there room for regulators to look at other ways of solving problems. Most of the activities assessed in a risk assessment produce some commercial benefit, or supposedly 'solve' a problem. However, by assessing the risks of hazardous activities and coming to the conclusion that some level of the activity poses no or insignificant risks of damage, the risk assessment process generally attempts to avoid the consideration of serious alternatives (O'Brien 2000). For example, the first UK national consensus conference on GM foods (Biotechnology and Biological Sciences Research Council 1994) was criticised for not engaging critical stakeholders in design and implementation – therefore effectively excluding consideration of alternatives to GM foods (Weldon and Wynne 2001). Nelson, Andow and Banker (2009) consider an alternative methodology for technology appraisal, which they term 'Problem Formulation and Options Assessment' (PFOA). This approach includes "deliberative formulation of problems and comparative assessment of future alternatives relative to the biosafety evaluation of GM crops" (Nelson, Andow and Banker 2009, p. 735) .

Further to this, De Sousa Santos (2004) speaks about the politics of possibility, which considers a 'sociology of absences'[25]. The aim of such a sociology is to give credibility to alternatives and ensure that these alternatives are *"discussed and argued for and their relations taken as object of political dispute"*, thereby creating the *"conditions to enlarge the field of credible experiences"* and widen "*the possibilities for social experimentation"* (Santos 2004, pp. 238-39). De Sousa Santos writes from a post-development perspective, a perspective which maintains that the concept/practice of development is a reflection of Western-Northern hegemony over the rest of the world and rises from the failures of the one-size-fits-all model of development: *"By this we mean a set of thinking and doing practices that are guided by a distinctive ethical stance"* (Gibson-Graham 2005). The following section examines the discourses of development as a phenomenology influencing the regulatory processes of GM crops in South Africa that is neither considered in current risk assessment approaches, nor by a feminist ethics of care approach. This will be followed by examining a post-

[25] It focuses on the processes that obstruct connections made between different knowledges and struggles, to demonstrate how the 'incompleteness' and 'inadequacy' of counter-hegemonic forms is produced. Santos suggests that hegemonic globalisation overlays an understanding of the global upon the world that erases local differences (Santos 2004)

development paradigm as providing a more suitable alternative to the approach of GM crop risk assessment, focusing on issues that are not addressed by current risk assessment practices, nor by a feminist ethics of care approach.

5.3 DISCOURSES OF DEVELOPMENT

Discrimination and Bias

A concern that a feminist ethics of care approach tends to neglect, and that was evident in the interviews and in government literature, is how historical discrimination, permeates current state policies. Regarding the agricultural sector, during the segregation period and well into the apartheid era, in seeking to limit competition from black farmers, the commercial farming industry was orchestrated and manipulated by state interventions to favour the predominantly white commercial farmers (Kheswa 2015). This ensured the success of (white) commercial farming in an otherwise futile industry and has resulted in the racialised association of white farming as 'successful', 'efficient' and 'commercially viable' and black farming as 'not workable' and 'in need of enhancing'. The bias towards commercial farming, historically associated with white farmers was summarised by an independent consultant who specialises in local economic development, food security and public-sector reform in South Africa, saying that *"there's very much this desire to replicate commercial white agriculture; it's held as the pinnacle of the agricultural scale and Bantustan agriculture is at the bottom of the scale" (P6).*

Current risk assessment practices operate as an enabling function of this bias towards commercial, industrialised agriculture because it views the GM crop in isolation of the farming system into which it will enter. In doing this, a risk assessment does not consider the socio-historical context of farming systems in the country. This, in turn, neglects how GM crops as part of a farming system might contribute to a specific mode of agricultural development that holds a particular history. Although 'context' is included in the feminist ethic of care framework, in the 'context' of GM crops in South Africa, as a post-colonial, post-apartheid state, solely *considering* the context does not go far enough: the approach must be developed from the context – as a starting point, not as something to be considered.

Development in agriculture is conceived of in a very narrow way by the South African government, that is the inclusion of smallholder farmers, into the economy that they have previously been excluded from in order to develop small-scale farms into industrial-commercial farms. Donna Andrews (2017) observes how this notion of inclusion and exclusion has also extended into the realm of food and women. She argues that dominant development discourses assume that the problem women have is that they are excluded from the market, excluded from capital, and that if included they will no longer be impoverished. Most analyses (UNDP 1980, IWF 2011) suggest that this exclusion stems from capitalism failing to reach into the *"kitchens and bedrooms of women"*. This presumption assumes that without capitalism, women remain feudal, pre-capitalist, and whatever women do in the kitchen and the bedroom is irrelevant to social change. Andrews (2017) argues that it is to this end, that institutions do their best to help women enter into capitalist relationships, rather than destroy these relationships that have oppressed them, and any analysis or solutions contrary to this are perceived to be irrational, nonsensical, and incomprehensible.

Developmentalism

In the context of South Africa, just considering 'context' as a theme of a wider framework does not go far enough in understanding how powerful and influential the socio-historical context of agriculture is in South Africa. The following section will look at how the economic theory of 'Developmentalism' of the 1950s and 60s, which permeated state policies in many developing countries in the South is a factor that has influenced the trajectory of agricultural development in South Africa - of which risk assessment plays an important part.

Developmentalism can be understood as "consisting of a set of ideas which converge to place economic development at the centre of political endeavours and institutions and also as a means through which to establish legitimacy in the political sphere" (Smith 1985, p. 533). Using this theory, economic development is framed by modern-day Western criteria in which economic success is judged in terms of capitalistic notions of what it means for a country to become developed, autonomous, and legitimate (Bin *et al* 1996). This emergent development discourse formed part of a broader initiative to restructure apartheid. The aim was to redirect the ideological discourse of the ruling white population to perform a legitimating function that would transform the explicitly racist and supremacist perceptions of the white population by portraying Africans as underdeveloped rather than racially inferior (Tapscott 1995, p. 177).

By the late 1980s, development was the preoccupation of many Western government agencies and NGOs (*Action Five* – Germany, *Agriculteurs Français Développment International* – France, *Development Cooperation with the Third World*, Austria)**.** Development policies were expected to raise standards of living for the 'have-nots' in the South to higher levels experienced by the 'haves' in the North, through the transfer of Northern technologies and their scientific rationality to the South. This was expected to raise the GDP of the country, through industrialised farming, fishing and forest management, backed up by 'trickle-down' economic theory[26]. This dynamic was regarded as the only way to raise living standards for citizens. Yet Harding (2006, p. 102) claims this relationship has its limits. She goes on to say that the Northern transfer of technology to the South did not prevent development from escalating militarism and transnational profiteering while worsening the conditions of precisely the groups in the South that 'development' and its scientific rationality were most supposed to benefit. The critiques of Northern development policies (Graeber 2011, Fergueson 1990, 2006, Escobar 1995) in and upon the South show how these processes have resulted rather in 'de-development' and 'maldevelopment'.

As well as the primacy of economic growth, a preoccupation with 'scientism' pervaded the writing of developmentalists (Millikan and Blackmer 1961, Shils 1961, Geertz 1963) who perceived underdevelopment in South Africa to be almost exclusively a function of inadequate methodology and the poor application of economic principles. Appeals made to science as the best medium for the resolution of the country's problems were most clearly evident in the system's approach to development (Tapscott 1995). This narrative still runs through the government's approach to the development of agriculture in which black South Africans are conceived of as underdeveloped, first, as a result of their exclusion from economic activity and second, as a result of their under-adoption of agricultural technology (Agriculture and Rural Development 2015, p. 16, National Development Plan 2012, p. 220-222).

This perspective was striking amongst government officials from various departments in which non-commercial farmers are perceived as underdeveloped and in need of developing if they are to become economically active (which is the ultimate goal) *(P1, P2, P3, P4, P5, P10)*. The pervasive thinking is

[26] Trickle-down economics is a theory that says benefits for the wealthy trickle down to benefit the rest of the population (Amadeo 2017).

that such farmers must be included in the economy that they were previously excluded from, and in the same way must have access to 'the basket of technologies' that will contribute to their development into commercial farmers *(P1, P2, P3, P4).* Risk assessment plays its part in this trajectory that aims to develop farmers by enabling the uptake of modern technology. Yet, due to its ultimate dependence on scientific information and expert analyses, it is perceived to be free of partiality and independent of any government rhetoric. However, as this study has shown, due to the subjectivity of risk and the subsequent process of risk assessment, certain values and perspectives are reflected: those which contribute to a certain *type* of 'development' of the agricultural sector, one that suggests the necessary productivity gains can come only from technological change and advancement.

The drive towards a technologically advanced agricultural system reflects the sentiments of the development discourse which equates whiteness with efficiency and in which the equilibrium characteristic of a 'traditional' society is broken down so that practices, which once formed part of a stable system, now cause problems and interact to exacerbate them. The task of governments and international aid agencies is to direct the transition to practices appropriate to the 'modern' world (Williams 1995, p. 172). According to Lithgelm and Van Wyk (1985, p. 327), "the development effort in Southern Africa is modelled on the traditional western capitalistic development strategy in which economic growth, rather than the structure of economic development, is regarded as the decisive factor." By aligning development strategy in South Africa in this way, critics would be compelled to query the logic of development theory, rather than the reality of political domination and underdevelopment in the Bantustans.

This rational optimism recognised science as the best way to resolve the country's problems and also contributed to the proliferation of development institutions, their associated common discourse and pool of 'experts' offering expert solutions. Underdevelopment in South Africa was commonly perceived as a "function of inadequate methodology and the poor application of economic principles". The new language of legitimation, with its own depoliticised and technocratic vocabulary, was instrumental in a programme to reconstitute the subjectivity of segments of South African society (Tapscott 1995, p. 189-190).

Another way in which the racial character of South African development strategies in agriculture have materialised can be found in the Proactive Land Acquisition Strategy of 2006 (PLAS, 2006) in which

resettled farmers[27] under this Strategy are given a three-year trial period during which time they have to prove their productivity if they wish to remain on the farm. Lulu Xingwana, Minister of Agriculture and Land Affairs at the time referred to this policy as 'use it or lose it' (Venter 2009). It must be noted that most land beneficiaries did not receive the titles to the land under the new regulation, rather, the titles were held by the government. Instead they received the right to farm the land, which could be taken away (Department of Land Affairs 2006, p. 18). This strategy was accompanied by a mentorship initiative with commercial farmers treated as mentors for emerging farmers (Niekerk, Groenewald and Zwane 2014). The system is premised on state ownership and long-term leases for beneficiaries and it takes fifty years of renting state land before beneficiaries get the right to apply to purchase the land. Rensburg (2017, p. 1) cites how "South Africa's increasingly business-orientated land reform programme has opened the door for 'elite capture' with businesses – often white owned and multinational – becoming the real winners, while black beneficiaries languish without any formal rights to the land."

A study carried out by Hall and Kepe that studied eleven randomly selected reform projects in the Sarah Baartman district of the Eastern Cape over a period of three years, arguing that "shifting policies have created a contorted reform governed by state officials, consultants and agri-business strategic partners concerned with surveillance and control of 'beneficiaries' in 'projects" (2017, p. 8). Another outcome of the study found that two of the projects did have leases with the state, but these were not held by the beneficiaries themselves but in cooperation with 'strategic partners', which usually involved an existing agri-business or white farmer - often the previous owner of the land in question. Hall and Kepe (2017, p. 8) call this 'elite state capture' of land reform in which "the state is not challenging the supremacy of private property, but rather becoming a significant player in the land market." The relationship between land, the state, and private business, operates to continue the exclusion of black farmers from their land that started in 1913 with the Land Act (SA History 2011). Not only does this manipulative relationship equate whiteness with efficiency, and reflect the on-going power of white agricultural capital and its influence on the state's agrarian policy but it also blurs the lines between private-corporate activities and government strategies that yet again neglect the needs of the people whom the strategies were designed to uplift. This race-class agricultural project pronounces a productivist mentality and does not consider alternative, non-productivist food sovereignty models (Helliker 2013).

[27] Farmers which had their land taken away from them under the apartheid government, but with new ANC ruling, have received portions of land that were previously taken.

The relationship between agriculture and land is clear and is even more controversial in the context of South Africa, yet this relationship is not reflected in legislation, policy or strategy relating to GM crops. For example, a representative of the Department for Land Affairs and Rural Development has never served on the Executive Council of the GMO Act, which again demonstrates the dissonance between land and agriculture on a government level. A feminist ethics of care places emphasis on relationships and power dynamics, which, in this case is very important for imagining a symbiotic, non-discriminatory form of GM crop governance. Neither the current mode of risk assessment, nor the process of risk analysis, deems the relationship between land and agriculture as worth considering, which ultimately leads to the formation of other, more destructive relationships.

5.4 POST-DEVELOPMENT

Though a feminist ethics of care accommodates the relevance of 'context' in the appraisal of GM crops, it does not prioritise it. For feminist care ethicists, context is a theme that must be considered within the framework. However, feminist ethics of care scholarship has its origins in the West, principally, in North America and thus is a projection of certain values upon the context of South Africa. Therefore, in the same way that a risk assessment approach has its roots in the European Scientific Revolution, both approaches have not been conceived of within the unique socio-historical context of South Africa. Harding (2008, p. 173), from a feminist, post-colonial standpoint maintains that there "should be multiple scientific traditions and practices, each responding to needs and desires of its own local cultural and social context."

This study suggests that any framework for risk appraisal must be conceived of from the origin of South Africa as a post-colonial, post-apartheid state. This process can begin by drawing upon post-development and decolonisation scholarship that provides a new way of conceiving the process of development. Post development holds that the concept and practice of development is a reflection of Western-Northern hegemony over the rest of the world and arises from the failures of the one-size fits all, economically focused model of development. Arturo Escobar, as a post development scholar, "traces the discursive creation in the immediate post-war period of the 'third world' as both the needy object of international development intervention and the excuse for expansion of a new world power's mode of global governmentality" (Gibson-Graham 2005, p. 4).

Writing from the standpoint of the global South, Boaventura de Sousa Santos, a Portuguese scholar (2004, pp. 238-39) provides an incisive and powerful account of the absences that are produced by Enlightenment thinking. He classifies five modes by which modern science with its core notions of rationality and efficiency have produced forms of 'non-existence' that can be seen to legitimise development thinking and practice as a logical response. The forms of non-existence derive from five monocultures (see Table 5). Post-development theories and thinking aim to deconstruct the project of development from the European experience of industrial growth and capitalist expansion and de-essentialise economic logic as the motor of history (Gibson-Graham 2005, p. 411). Santos (2004, p. 240) asks us to pursue instead a sociology of absences in order to give credit and attention to the absences and confront the ways in which 'non-existence' is produced by replacing each of the monocultures with "ecologies of knowledges, temporality, recognition, trans-scale and productivity" (Gibson-Graham 2005, p. 411). In doing this we acknowledge and practice diversity and multiplicity and reject the exclusive credibility of hegemonic practices.

In the context of GM crops, these monocultures are entirely evident and would benefit from analysis from this perspective. According to Okunlola *et al* (2016) there are 47,113 small holder farmers in South Africa and with them, is an intimate knowledge of the land, of weather patterns, of seed and how these knowledges are in continuous exchange and balance with one another. When GM technology is introduced into such communities, it displaces indigenous knowledge systems of agriculture and food consumption and nutrition patterns[28]; the introduction of 'modern' technology thus ultimately results in cultural displacement. Perlas (1995, p. 245) looks at how the oral tradition of communication and generational skill transfer has been lost; primarily due to the language of modernization which belittles farmers' knowledge as primitive and then deems them illiterate. In a similar way, enlightenment thinking holds a preoccupation with 'progress', 'development', 'improvement and 'moving forward' which uses modern technology to increase economic power. This discredits any form or practice that does not pursue these aims as 'backward' and 'primitive' and in desperate need of modernisation and development in order to join the race.

In South Africa, this is a race towards mechanisation and technology, and can be understood in racial terms. For example, commercial white farmers who historically have had access to modern agricultural technology are housed within the Department of Agriculture, Forests and Fisheries. In contrast, most black, smallholder farmers, using traditional farming methods that have previously

[28] See McAffee (2008) for examples of this from Mexico and Scoones (2006) for examples from India

been excluded from the 'basket of technology' are housed within the Department of Land Reform and Rural Development (Ledger 2016). There is a clear split that is built on the standard discourse of development that preaches a notion of 'moving forward' and 'graduating' from the past into a mechanised future.

Table 5, The Five Monocultures of Non-Existence (De Sousa Santos 2004)

Monoculture of Knowledge	Modern science is high knowledge and the sole criterion for truth. Simultaneously produces 'non-existence' in the form of ignorance/lack of culture.
Monoculture of Linear Time	Holds the assumption that forwards in time ensures progress. 'Backwards' in time is somehow worse and not desirable.
Monoculture of Classification	Populations distributed according to categories that naturalise[d] hierarchies, leading to inferiority and subordination.
Monoculture of 'The Universal'/'The Global'	Logic of the dominant scale that sees the local/the particular as nuisances and obstacles to efficiency.
Monoculture of Capitalist Productivity	Privileges growth through market forces. Produces non-existence in the form of the non-productiveness of non-capitalist economic activity and thus *needs* development.

The post-development agenda is not anti-development; its challenge is to imagine and practice development differently, in order to delink it from an Enlightenment notion of development and instead create a new discourse from a Southern or subaltern[29] perspective. Post development theories of science and technology studies (PCSTS) are fuelled by the desire to tell a counter-version of the histories. They aim to present practices of both non-European and European sciences, especially the history of interaction between them with the aim of providing a counter-narrative to the triumphalist Western account of Third World development policies (Gibson-Graham 2005).

[29] In critical theory and post-colonialism, the term **subaltern** designates the populations that are socially, politically and geographically outside of the hegemonic power structure of the colony and of the colonial homeland. In describing 'history told from below', *subaltern* was coined by Antonio Gramsci, notably through his work on cultural hegemony, which identified the groups that are excluded from a society's established institutions and thus denied the means by which people have a voice in their society (Prakash 1994).

5.5 CRITIQUE OF THE PUBLIC/PRIVATE DISTINCTION

Although a feminist ethics of care seeks to reconceptualise the dichotomy between public and private, its usefulness has been criticized by black feminists as a liberal and white concept (King 1988). They point out that the split between public and private life[30] does not hold true in the same way for all women, revealing the concept's Eurocentric bias (Bergetz 2009). Patricia Hill Collins (1998) for example, argues that for African-American communities, 'public' and 'private' might not be the most appropriate categories to consider, because they rely on the archetypal white, middle-class nuclear family where a relatively fixed sexual division of labour exists: women's roles are situated in the home and men's - in the public world of work. This ideal also assumes the separation of work and family. In general, Collins (2002, p. 47) states; "everything the imagined traditional family ideal is thought to be, African-American families are not". The way in which racial oppression has disadvantaged many black families has meant that black women and other women of colour seldom fit into this model. Poor families, Collins (2002) argues, cannot so easily divide their experiences between the public and the private realms because black women's paid labour is often domestic labour in another household. This means that black women's labour is often neglected by feminist discourses.

Collins (1998) takes the analysis further by saying it would be more beneficial to challenge the embedded social constructs of 'work' and 'family', rather than trying to describe why it is that Black women's work and family arrangements deviate from the seeming normality of the traditional family ideal. This analysis challenges the reconceptualisation of the public/private division that a feminist ethics of care calls for and asks us to rather challenge and weaken the foundation that supports these tenuous distinctions.

Speaking from a Southeast Asian perspective, Maila Stivens (1991), notes that it is hard to define the private sphere in agrarian societies. She discerns the gendering of all levels of social life throughout the traditional public/private distinction and claims that society's perception of politics should change, rather than analyse all societies within the confines of a particular western construction of the

[30]The public/private dichotomy is central to feminist movement expressed in the slogan 'The personal is Political'. It is scathing critique of the traditionally forged wall of separation between the political or the public sphere consisting of state, government and the personal and private sphere comprised by the family and personal relationships (Kumari 2017).

public/private divide. Other scholars have observed how this dichotomy becomes problematic for women in a rural, agricultural context.

Work by Mellow (2006), based on interviews with rural Protestant clergymen and women found that in rural life, a gendered division of labour for domestic responsibilities persists but public and private realms are not so clearly separated. McMurry (1988, p. 57) concludes that while cultural prescriptions are advocated for distinct tasks and spaces for women and men's labour, the physical and economic interdependence of home and farm in subsistence farming precludes the establishment of rigid boundaries between the spheres. These analyses demonstrate how what is 'public' in one society may well be 'private' in another. A similarity, as Imray and Middleton (1983, p. 16) suggest, is that women's activities are consistently devalued by being construed as private. A feminist ethics of care does not seek to abandon the concept of public/private, but rather to reconceptualise the boundaries, which have been socially constructed to associate men and their activities with 'the public' and women and their activities with 'the private' (Held 1995, Tronto 1993). This reconceptualisation most often calls for the inclusion of women in political-public life and for an ethic of care to transcend this division and gain legitimacy in the public sphere.

In light of this, in order to avoid the marginalisation of black women and rural women in the context of GMO risk appraisal, it may be necessary to abandon the public/private dichotomy. In the context of rural agriculture in South Africa, the NGO Biowatch has found that women are the primary seed custodians, who possess knowledge around the seeds that they save and look after; *"they are the ones who will make sure there's enough seed to be planted the next year - even if there's a drought" (P22)*. Yet the distinction between the public and the private spheres of existence functions to make women's work and women's needs - invisible. Economic visibility depends on working in the public sphere while unpaid work in the home or community is categorised as 'unproductive, unoccupied, and economically inactive' precisely because it is unseen through public eyes (Dreze and Sen 1989). Marilyn Waring (1999) has argued that this division, which is institutionalised in developed nations, has been exported to the developing world through the UN System of National Accounts (UNSNA)[31] and operates as another tool of colonialism. Biowatch expressed how the invisibility of women and their needs has extended into the sphere of risk assessment, which "never had these women in mind," *(P22)*. The participant then goes further and disagrees with the term 'marginalisation' used by the

[31] The internationally agreed standard set of recommendations on how to compile measures of economic activity (UN 2017)

researcher, in regard to women, by saying that their issues and rights *"have never even been thought of" (P22).* Here, it's not a case of marginalisation but of absolutely never having been considered. It is interesting to note here that Biowatch mention how one of the key founders of SAGENE, the committee who instigated regulatory procedures for GM crops in South Africa, is a woman, yet women have been completely neglected by these regulations. This demonstrates how simply 'adding women' (Harding 2008) to the regulatory processes of GM crops, does not solve the problems that women face. This is because the system of regulation is built upon the exclusion of women, which is achieved through the public/private distinction, which inherently privileges men and their activities.

Studying the oppression, dispossession of women and other marginalised groups should not be an 'add-on' but should be integral in helping to understand the processes of patriarchal capitalist accumulation. Any amendment to a framework that may be used to reconceptualise the process of risk analysis must grow from the standpoint of women and other marginalised groups. This analysis echoes the way in which black South African farmers are encouraged to adopt modern farming techniques in order to enter into the commercial agricultural system, the success which was based upon their exclusion.

Harding (2008, p. 160) observes that the public/private dichotomy, as a Eurocentric and androcentric conceptual framework has been exploited by 'development' policies and agencies. She argues that projects in this field "have not distanced themselves from the dominant frameworks in ways which permit actualisation of the assumption that important insights about sciences and technologies of the First and Third Worlds can be gleaned by starting of analysis from the standpoint of women." Women are not seen as models of *'rational man', 'manufacturers of knowledge', 'revolutionary heroes',* or *'indigenous knower'*. Therefore, rarely do science and technology studies take into account the perspectives and issues of most importance to Third World women. This misunderstanding of the problem; the way of seeing the marginalisation of women in development policies, leads to the mis-formulation of appropriate solutions which has resulted in an increase in women's poverty around the globe, both in absolute numbers and relative to that of men (Harding 2008, p. 160).

5.6 FEMINIST ETHICS OF UBUNTU

In response to the former, Gouws and van Zyl (2015), writing from the South African perspective, state the importance of working towards a feminist ethics of *Ubuntu*[32]. They propose that when looking at the production of moral philosophies, feminist knowledge was marginalized in much the same way as African moral theories. In practice, the dominance of the human rights framework as a universal moral paradigm has been based on an individualist ontology that has eclipsed relational ontologies like a feminist ethics of care and *Ubuntu*. Centring themselves in Africa means they also speak critically of the dominant Northern discourses of rights and justice and instead propose a feminist moral theory from the South by bridging rights and *Ubuntu* to synthesize a southern feminist relational ethic of justice, bridging the fractures between dominant moral discourses emanating from the north with moral discourses embedded in heteropatriarchies from Africa.

Gouws and van Zyl (2015) posit that justice must take into account a relational perspective, not meaning that the individual is set apart from the community, nor that the individual is subject to community will, but that all individuals are situated in a community. They see care as the symbol for communal relationships representing reciprocal responsibilities as well as a source of dignity and equality. In a fragmented society, holding deep inequalities, concepts of justice need to acknowledge relational understandings of our mutual dependencies on, and reciprocal responsibilities to each other - "for the majority of individuals to thrive, the whole society needs to flourish" (Gouws and van Zyl 2015 p. 166). The concept of 'the self' in a communitarian philosophy stands in stark contrast to the Hobbesian conception of self as a person who springs fully formed from nature as a rational, independent, self-determining individual who enters into social contracts with others (Held 1990). In *Ubuntu*, ancestry, kinship, and community are woven into the self through a myriad of social and affective bonds. Steve Biko[33] even included *Ubuntu* as part of his liberation ideology to restore Africa's humanity. A feminist ethics of *Ubuntu* acknowledges lifelong practice of feminism and location in the South and Southern Africa in particular.

[32] Ubuntu is a philosophy emanating from Southern Africa that states; "I am what I am because of who we all are." (From a definition offered by Liberian peace activist Leymah Gbowee)

[33] Steve Biko (1946 -1977) was a South African anti-apartheid activist. Ideologically an African nationalist and African socialist, he was at the forefront of a grassroots anti-apartheid campaign known as the Black Consciousness Movement during the late 1960s and 1970s (Hill 2015)

Ubuntu has legitimacy in Africa as an indigenous ethical framework of care, in contrast to Northern liberal moral frameworks. However, in practice, *Ubuntu* has relied on normalized discourses of patriarchal and gerontocratic[34] hierarchies, othering people with low status, young people, women and gender non-conforming people. Therefore, like other ethical frameworks, *Ubuntu* falls short in the implementation of its rhetoric of equality and dignity (Gouws and van Zyl 2015, p. 175). It is here, that the synchronization of a feminist ethics of care from a northern perspective and a South African vision of *Ubuntu* can intersect and form a localized ethical practice.

5.7 SUMMARY

This discussion has served to examine the ways in which a feminist ethics of care may not be the most suitable approach to GM crop risk assessment in South Africa. It has discussed the ways in which it fails to emphasize the importance of context and how the divisions of the public and private actually reinforce problematic ways of seeing the issues that rural women face. It concludes that solutions built upon these assumptions will continue to marginalise women and further entrench patriarchal systems. This section has suggested that a post-development paradigm may provide a more suitable point of departure for devising a more appropriate framework for the assessment of GM crops in South Africa, due to its origin in the global South. Then, a feminist ethics of *Ubuntu* was explored as a bridge between an ethic of care and a form of localised and particular moral philosophy.

[34] A gerontocracy is a society where leadership is reserved for elders.

CHAPTER SIX

6.0 CONCLUSION

6.1 PROJECT SUMMARY

This thesis has sought to explore a feminist ethics of care approach as an alternative paradigm with which to assess GM crops in South Africa, the importance of which has never been greater. While the country is in the midst of escalating environmental challenges, accompanied by uncertain and unstable political futures on a national and global level, increasing pressure falls upon the farmers and the seed savers who must balance a myriad of obstacles to ensure that mouths are fed. This increasingly demanding situation is met by the promise of technological agricultural development, of which GM crops are said to play a major part. However, the benefits of this novel technology are not benign, and their proliferation must be interrogated and met with an alternative approach to regulation in order to illuminate and assess issues and risks that are being overlooked by the current science-based, risk approach to the appraisal of biotechnology. Ethical issues are said to lie outside the scope of current risk appraisal. A feminist ethics of care seeks to re-centre these important issues and claims that decisions on GM crops are inherently ethical and thus in need of inclusion in assessment procedures.

This study has aimed to provide an academic critique of current science-based risk assessment practices and to declare the inadequacy of risk analysis procedures. Procedures have been shown to be reductive, non-democratic and steeped in a history of segregation and injustice. Following this critique, a feminist ethics of care was explored as an alternative lens through which to view the assessment of GM crops. By using themes derived from feminist literature such as relationships, particularity and context, power and vulnerability, narrative and voice, emotion and new conceptualisations of the public/private dichotomy, it is revealed that many issues have been missed and neglected by the utilitarian and largely consequentialist science-based risk assessment. A feminist ethics of care encourages a broadening of the scope of risk assessment and analysis in order for salient issues to be brought to light, acknowledged, and confronted.

6.2 CONCLUSIONS

By exploring the historical evolution of risk assessment procedures of GM crops in South Africa, this study has critically analysed the failings of current GM crop assessment practices. It was found that appraisal is heavily dependent on quantitative-scientific information produced by 'experts' that have a particular way of seeing the world. These perspectives are seemingly taken much more seriously than those of others who do not necessarily possess the knowledge or the language to partake in technocratic processes. In addition to this, risk assessment depends on perceiving the genetic modification of crops in isolation of the agri-food system in which they will enter, thus ignoring synergistic environmental effects and socio-economic, political and cultural ramifications. The government perceives the risk assessment of GM crops as a benign tool, in isolation of the industrial farming system of which it is a part and simultaneously promotes. This reduction of complexity is useful for risk management purposes but is not a true representation of the real and lived potential exposure to the identified risks. Power and vulnerability are aspects that are deemed to lie beyond the scope of risk analysis, yet as this research has shown, characterise relationships that exist across the GM crop landscape, holding the potential to advantage the few and disadvantage the many. Power is exercised when defining the risks of planting a GM crop and stating what the benefits may be. Still, proponents of risk assessment and risk analysis view them as neutral governance tools. In addition to this, it was found that due to the reliance of risk assessment on quantitative, scientific information and evidence, 'expert' voices are often the only voices that are heard during risk appraisal, meaning that other people, with other ways of knowing and seeing the world are left essentially voiceless, with no power to be active stakeholders in a process that influences their lives and their communities.

The effect of the neoliberal growth narrative was found to be a heavy influencing factor in risk appraisal and the relationship between economics and science across the GM crop landscape, was found to be strong. Current risk appraisal procedures see farmers as economic subjects who have either been previously excluded from agricultural-economic activity, and yet to be included, or as economically active participants in the agricultural economy. This capitalist perspective turns crop as food to crop as commodity, thus, de-humanising the very intimate, social and culturally tied process of growing and eating food. A feminist ethics of care approach to risk assessment acknowledges that scientific experts, in the same way as the public, make decisions that are influenced by emotion and affect and this is something to be recognised, not ignored or disregarded as an obstacle to perceived

objectivity. Finally, the liberal Western imposition of the public and private distinction has meant that socio-economic, political and cultural concerns are essentially left to the market. This makes responsibility for errors or wrongdoings difficult to trace and enforce. The demarcation of public and private spheres of activity in the context of GM crops has meant that as the free market expands and capital accumulates amongst an oligopoly of corporations, NGOs have had to, at the same time, monitor this expansion in order for social and environmental justice to remain important. Moreover, a science-based risk approach to appraisal does not demand, or encourage regulators to look at possible alternative solutions, to the problems that GM crops promise to solve.

Investigating the suitability of a feminist ethics of care framework for use in the appraisal of GM crops was another objective of this research. By using a feminist ethics of care framework to interrogate current risk assessment practices, we are provided with new 'ways of seeing' risk; not simply as an objective, quantifiable statistic, independent of value, time and space, but, as Latour (1991) would suggest - as a form of 'quasi-object'; an intersection of forces, objects and agents (Latour 1991, p. 10). Indeed, feminist perspectives ask us to broaden the framing of the issue, to consider different kinds of knowledge, to re-imagine ourselves as social, rather than economic subjects, to be open to alternatives, to tap into the capacity of socio-ecological relations and to recognize power dynamics to ensure the inclusion of voices currently missing from the political discourse. Feminist perspectives suggest there is 'a way to' risk that is non-linear, indirect, derives from no single origin, and traverses our moral landscape.

Yet, while many of the feminist themes do bring to light salient issues that the current mode of risk appraisal omits and excludes - it too bears some problems. First, whilst a science-based risk approach to GM crop appraisal has its roots in Western Europe, similarly, a feminist care ethics has its origins in the West, primarily in North America. This represents a society that is considered an advanced democracy and where the realities of the everyday, lived experience are very different from those of the majority of people living in South Africa. This therefore results in yet again, a projection of Northern values upon a country in the global South, echoing the problematic discourses of development. Further to this, due to its origins in the West, a feminist ethics of care remains preoccupied with the public/private distinction, which as has been explored, is very limiting for women of colour and those engaged in rural agricultural contexts. Second, a feminist ethic of care does highlight the need to consider the greater context and indeed this is one of its strengths. However, any framework that is put forward to enhance and democratise the regulatory process of

GM crops in South Africa, as a post-colonial, post-apartheid state, must emphasise and explicitly integrate the country's socio-historical context in relation to land and agriculture. This analysis raises questions of the relevance of a feminist ethics of care approach to the unique context of South Africa.

These findings also suggest that the current approach to GM crop assessment and the care ethic framework do not have to be mutually exclusive and also that the process of transitioning towards a more holistic framework would benefit from the approaches 'working together' (Verran 2001). However, after exploring how appropriate a feminist ethics of care approach to GM crop assessment may be, it is concluded that although some of the themes do resonate, the Western origin of the framework reduces its suitability. A post-development framework may be a more appropriate lens to use, firstly, due to its origins in the global South and secondly, due to its explicit critique of modernity and Western development strategies. Arturo Escobar (2004, p. 255) explains, "Modernity can no longer be treated as the Great Singularity, the giant attractor towards which all tendencies ineluctably gravitate, the path to be trodden by all trajectories leading to an inevitable steady state. Rather, modernity and its exteriorities ... should be treated as a true multiplicity, where trajectories are multiple and can lead to multiple states".

This statement encompasses the essence of the findings of this research and encourages the view that there are multiple agricultural development pathways that may be pursued. In light of this, it is recommended that South Africa, as a post-colonial, post-apartheid state, and engaged in a subaltern reality must not subscribe to one particular framework or approach that has its roots in the West, nor one that propagates that there is only one pathway to development. Rather, the country should seek to understand its unique position and select modes of thinking and doing that enhance rather than denounce its capacity for multiple development trajectories.

6.3 POLICY RECOMMENDATIONS

In order to achieve the fourth objective of the thesis and transform the findings of the research into practical measures that can be implemented into government strategies, this section will begin to formulate some policy recommendations.

This research has shown that the current system of GM crop regulation in South Africa is flawed and many of the issues that have been raised stem from a particular way of seeing, thinking and speaking

about certain risks. Resolving these types of embedded concerns will be a difficult challenge and will require fundamental, systemic change that genuinely seeks to alter our perceptions of ourselves, each other and the environment in which we inhabit. Reforming a system that is so deeply entrenched in a neoliberal conception of nature and society will be gradual, developmental and require continuous reflection but will also benefit from smaller, more incremental steps towards the wider goal.

In light of this, a transitional process in encouraged. Some transitional steps might include, widening the panel of the Advisory Committee (AC) to include a social scientist and an ecologist, the inclusion of a representative from the Department of Land Reform and Rural Development on the Executive Council (EC) and making the consideration of alternatives to GM crops mandatory in Risk Analysis procedures. Further to this, it is recommended that greater engagement between stakeholders is facilitated in a way that is inclusive, democratic and does not require specialist, scientific or technical language. This would be complemented by ceasing to use the antagonistic phrases of 'for' and 'against' (GMOs) that dominates and so often prevents useful discussion. A more multifaceted and holistic assessment of GM crops should be stimulated by asking a different set of questions that address concerns beyond human health and the environment and stem from other ways of perceiving of our environment. For example, asking questions not just about crop yield, but also about the *type* of yield, its nutrition, taste, local resilience and sustainability. Further, to encourage the practice of reflexivity in the regulation of GM crops, establish an independently facilitated assessment by the EC of past GM crop permit decisions that have been issued as a result of the science-based risk approach. This kind of self-reflection can start to integrate reflexivity into existing institutions and begin to change the nature of decision-making within them.

Principally, focus should be placed on shifting perceptions of GM crops and broadening the lens through which they are seen: not as isolated events, but rather, as nodes of socio-ecological relations that encourage the proliferation of industrial and mechanised farming. Acknowledging that GM crops are contextually very different from conventional crops and can profoundly transform social arrangements, ecological systems and material structures (Wickson et al 2017) is a vital first step that must be taken in order for this shift in perception to take place. Finally, incorporating vision and imagination into a new framework for assessment is essential for realising a desirable and sustainable agricultural future for South Africa.

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Appendix 1: Participant Information Sheet and Informed Consent

UNIVERSITY OF CAPE TOWN

PRIVATE BAG
RONDEBOSCH 7701
SOUTH AFRICA

Informed Voluntary Consent to Participate in Research Study

Title of research project: Exploring a Feminist Ethics of Care as a means to Broaden the Scope of Current GM Crop Risk Assessment Practices in South Africa
Names of principal researcher: Jennifer Whittingham
Department/research group address: Environmental and Geographical Science
Telephone: 0606478058
Email: jenw@live.co.uk

Context Information on MPhil research: The historical trajectory of GM crops in Africa has been turbulent to say the least and their future is set to be no less so. The task of deconstructing and understanding the nuances and complexities present in the GM crop debate is intricate, convoluted and inconclusive. There are many stakeholders involved at various different levels and in varying capacities, which problematizes the assessment of a technology with such a multifaceted nature. Through this research I want to explore how a Feminist Ethics of Care approach can develop the assessment of GM crops to be more holistic and inclusive.

Nature of the Research/Methods: The study takes a mixed methods approach – selecting the most appropriate methods to achieve the research objectives. I hope to spend time interviewing various stakeholders involved in GM crop regulation, from government officials to scientists, academics and NGOs. I will also carry out analyses on GM crop application documents. During this study you will be asked to participate in an interview that will last approximately an hour and will be recorded unless the participant specifies otherwise.

Risks: There are no potentially harmful risks related to your participation in this study.

Disclaimer/Withdrawal: Your participation is completely voluntary; you may refuse to participate, and you may withdraw at any time without having to state a reason and without any prejudice or penalty against you. Should you choose to withdraw, the researcher commits not to use any of the information you have provided without your signed consent. Note that the researcher may also withdraw you from the study at any time.

Confidentiality: All information collected in this study will be kept private and you will not be identified by name. Confidentiality and anonymity will be maintained, participants will be assigned numbers that will be used in the writing of the thesis, in place of names.

What signing this form means: By signing this consent-form, you agree to participate in this research study. The aim, procedures to be used, as well as the potential risks and benefits of your participation have been explained verbally to you in detail, using this form. Refusal to participate in or withdrawal from this study at any time will have no effect on you in any way. You are free to contact me, to ask questions or request further information, at any time during this research.

I agree to participate in this research project: Y / N

Name and Signature of Participant _____ Date: _____

Name and Signature of Researcher _____ Date: _____

Appendix 2: List of Participants and Institutional Affiliation

(P1)	Biosafety South Africa	South Africa
(P2)	Biosafety South Africa	South Africa
(P3)	DAFF (Department of Agriculture, Forests and Fisheries)	South Africa
(P4)	DAFF (Department of Agriculture, Forests and Fisheries)	South Africa
(P5)	DAFF (Department of Agriculture, Forests and Fisheries)	South Africa
(P6)	University of the Witswatersrand	South Africa
(P7)	SPRU (Science & Policy Research Unit)	UK
(P8)	SPRU (Science & Policy Research Unit)	UK
(P9)	ETHZ Zurich's Institute of Integrative Biology	Switzerland
(P10)	DST (Department of Science & Technology)	South Africa
(P11)	Genøk Centre for Biosafety	Norway
(P12)	Genøk Centre for Biosafety	Norway
(P13)	Genøk Centre for Biosafety	Norway
(P14)	Genøk Centre for Biosafety	Norway
(P15)	Genøk Centre for Biosafety + Northwest University	Norway, South Africa
(P16)	Genøk Centre for Biosafety	Norway
(P17)	African Centre for Biodiversity	South Africa
(P18)	SAGENE + University of Cape Town	South Africa
(P19)	Northwest University	South Africa
(P20)	Northwest University	South Africa
(P21)	Northwest University	South Africa
(P22)	Biowatch	South Africa
(P23)	Northwest University	South Africa